
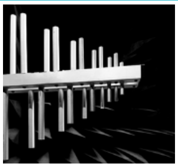
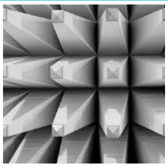

CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

Test report no.: 1-1679/21-01-02

Testing laboratory

CTC advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
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Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate starting with the registration number: D-PL-12076-01.

Applicant

Globtel Holding d.o.o.
Panonska 30
2000 Maribor / SLOVENIA
Phone:
Contact: Borut Štumberger
e-mail: borut.stumberger@air-tv.net
Phone: +386 2 620 2 000

Manufacturer

Globtel Holding d.o.o.
Panonska 30
2000 Maribor / SLOVENIA

Test standard/s

FCC - Title 47 CFR Part 15	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 10	Radio Standards Specification - Licence-Exempt Radio Apparatus: Category II Equipment
RSS-GEN	General Requirements for Compliance of Radio Apparatus

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	**AIR Base Station**
Model name:	**AIR GIGARAY INTEGRA D70U81**
FCC ID:	**2AWXTAIRGRMP70803**
IC ID:	**27453-AIRGMP70803**
Frequency:	57 – 71 GHz Band (EUT 69.5 – 71 GHz)
Antenna:	Sector horn antennas V and H polarization, ~20.7 dBi
Power supply:	48 V DC ±15%
Temperature range:	-20°C to +55°C

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:

cn=Meheza Walla, o=CTC advanced GmbH, ou=WAL-200806, email=meheza.walla@ctcadvanced.com, c=DE
2021.07.13 15:31:34 +02'00'

Meheza Walla
Lab Manager
Radio Communications & EMC

Test performed:

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2021.07.13 15:16:37 +02'00'

Thomas Vogler
Lab Manager
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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2.2 Application details

Date of receipt of order:	2021-05-25
Date of receipt of test item:	2021-05-25
Start of test:	2021-05-25
End of test:	2021-06-13
Person(s) present during the test:	Mr. Iztok Kodrič (during set-up) Mr. Malek Kuzmič (during set-up)

2.3 Test laboratories sub-contracted

None

3 Test standard/s, references and accreditations

Test standard	Date	Description
FCC - Title 47 CFR Part 15		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 10	12-2019	Radio Standards Specification - Licence-Exempt Radio Apparatus: Category II Equipment
RSS-GEN	03-2019	General Requirements for Compliance of Radio Apparatus

Guidance	Version	Description
ANSI C63.4-2017	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Accreditation	Description	
D-PL-12076-01-04	Telecommunication and EMC Canada https://www.dakks.de/as/ast/d/D-PL-12076-01-04.pdf	ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-04
D-PL-12076-01-05	Telecommunication FCC requirements https://www.dakks.de/as/ast/d/D-PL-12076-01-05.pdf	ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-05

4 Test environment

Temperature :	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests +55 °C during high temperature tests -20 °C during low temperature tests
Relative humidity content :		48 %
Barometric pressure :		1010 hpa
Power supply :	V_{nom} V_{min} V_{max}	48 V DC 40.8 V DC 55.2 V DC

5 Test item

5.1 General description

Kind of test item	:	AIR Base Station
Type identification	:	AIR GIGARAY INTEGRA D70U81
S/N serial number	:	35-0003
HW hardware status	:	1.0
SW software status	:	1.0
PMN	:	AIR Gigaray 70/80
HVIN	:	AIRGMP70803-1
FVIN	:	AIRGMP70803-1F
HMN	:	-/-
Frequency band TX	:	57 – 71 GHz (EUT 69.5 – 71 GHz)
Frequency band RX	:	81 – 82.5 GHz
Type of radio transmission Use of frequency spectrum	: :	OFDM (DOCSIS 3.1 protocol)
Type of modulation	:	512QAM
Baseband input signal	:	500 – 1000 MHz
Conducted output power	:	20 dBm (avg.)
Antennas	:	Sector horn antennas V and H polarization, ~20.7 dBi Antennas at -30°, 0° and +30° angle orientation from mechanical boresight. -30° : 69.5 – 70.0 GHz 0° : 70.0 – 70.5 GHz +30°: 70.5 – 71.0 GHz
Power supply	:	48 V DC ±15%
Temperature range	:	-20°C to +55°C

5.2 Additional information

The tested DUT is a transceiver/booster for DOCSIS signals. The modulation is usually done by a built-in DOCSIS unit. For testing the DUT a Rohde & Schwarz CLGD DOCSIS generator was used to generate modulated signals as described by the applicant (OFDM with 512QAM at 500 - 1000 MHz and 96/192 MHz bandwidth acc. to DOCSIS 3.1 protocol).

The DOCSIS generator was leveled to saturation of the EUT amplifiers by using a power meter, with the expected conducted output power of 15 - 20 dBm avg.
For full band use and due to the limitation of the peak EIRP to 43 dBm acc. to FCC part 15.255 the maximum input power level to the downlink RF part needs to be reduced by 6 dB from saturation.
See conducted power and radiated EIRP results for details.

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup and EUT photos are included in test report: 1-1679/21-01-01_AnnexA
1-1679/21-01-01_AnnexB
1-1679/21-01-01_AnnexD

6 Sequence of testing

6.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, it is placed on a table with 0.8 m height.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement*

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

Final measurement

- Identified emissions during the pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

*)Note: The sequence will be repeated three times with different EUT orientations.

6.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position ± 45° and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

6.3 Sequence of testing radiated spurious 1 GHz to 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

6.4 Sequence of testing radiated spurious above 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet.
- The measurement distance is as appropriate (e.g. 0.5 m).
- The EUT is set into operation.

Premeasurement

- The test antenna is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.

Final measurement

- The final measurement is performed at the position and antenna orientation causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement and the limit is stored.

6.5 Sequence of testing radiated spurious above 50 GHz with external mixers

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet.
- The measurement distance is as appropriate for far field (e.g. 0.25 m).
- The EUT is set into operation.

Premeasurement

- The test antenna with external mixer is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.
- Caution is taken to reduce the possible overloading of the external mixer.

Final measurement

- The final measurement is performed at the position and antenna orientation causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- As external mixers may generate false images care is taken to ensure that any emission measured by the spectrum analyzer does indeed originate in the EUT. Signal identification feature of spectrum analyzer is used to eliminate false mixer images (i.e., it is not the fundamental emission or a harmonic falling precisely at the measured frequency).
- Final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement and the limit is stored.

7 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

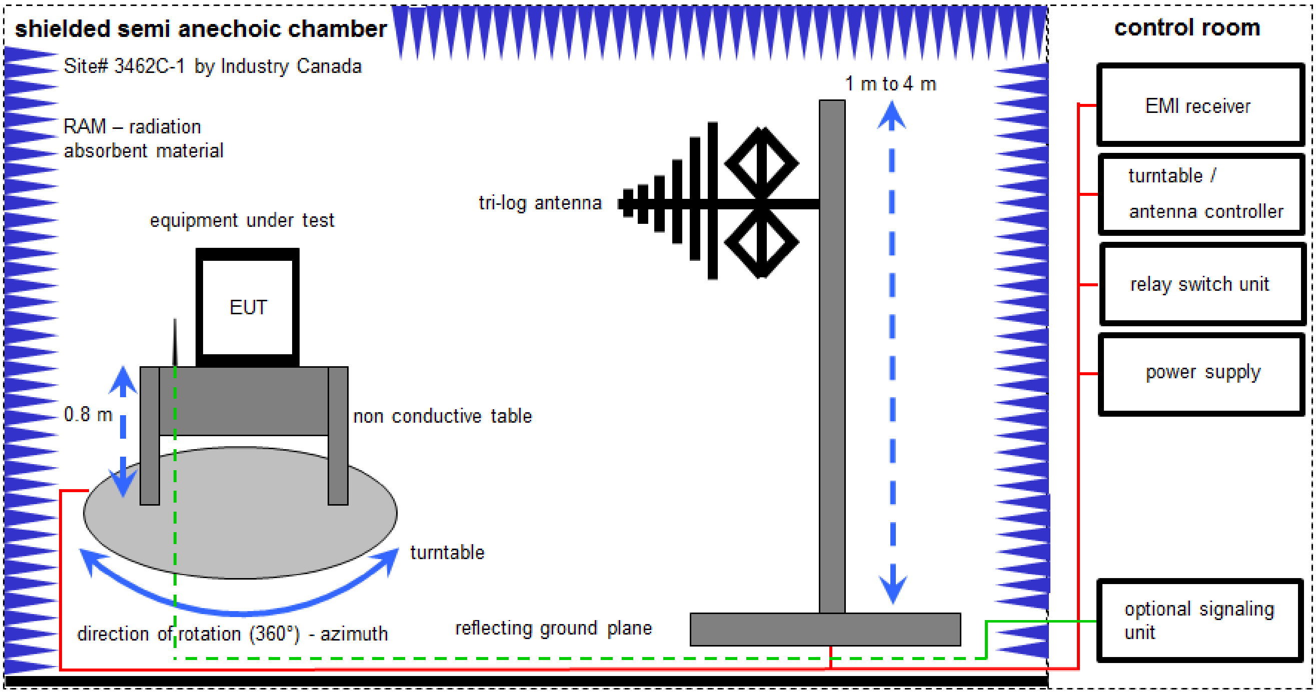
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlkI!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.

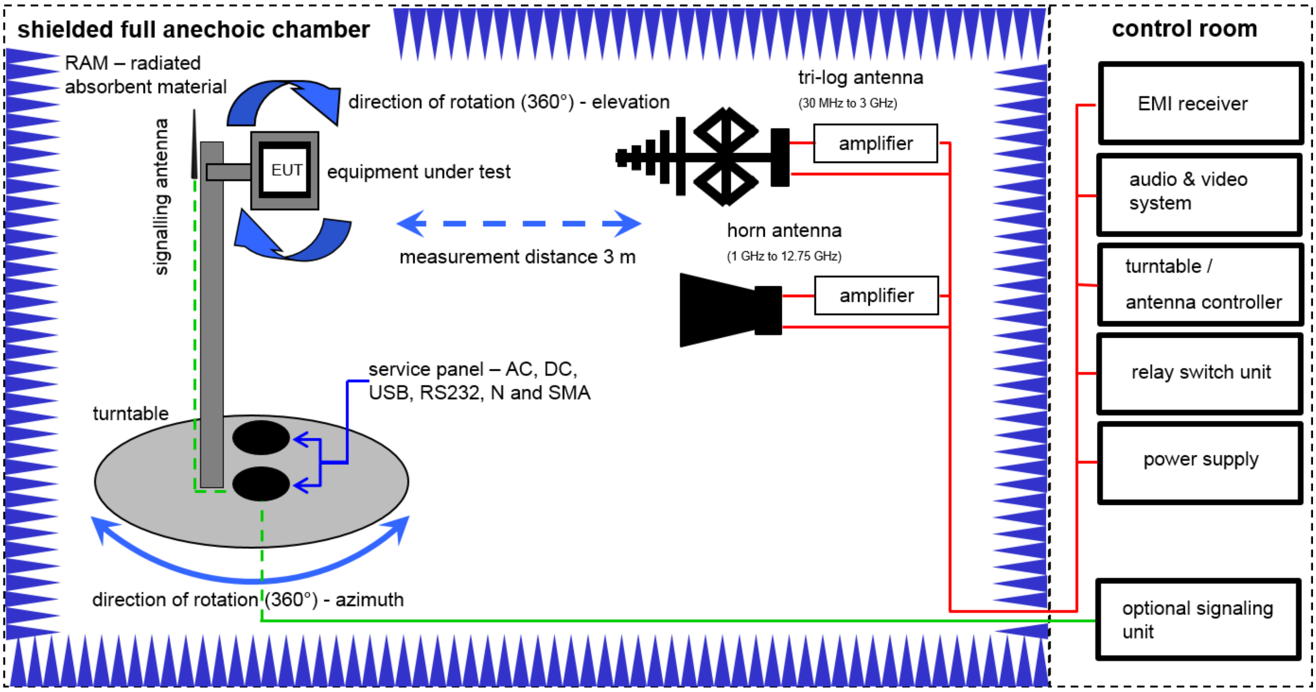


Measurement distance: tri-log antenna 10 meter

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-
3	n. a.	Meßkabine 1	HF-Absorberhalle	MWB AG 300023		300000551	ne	-/-	-/-
4	n. a.	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	09.12.2020	08.12.2021
5	n. a.	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
6	n. a.	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
7	n. a.	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
8	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	318	300003696	vIKI!	04.09.2019	03.09.2021
9	n. a.	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
10	n. a.	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	10.12.2020	09.12.2021

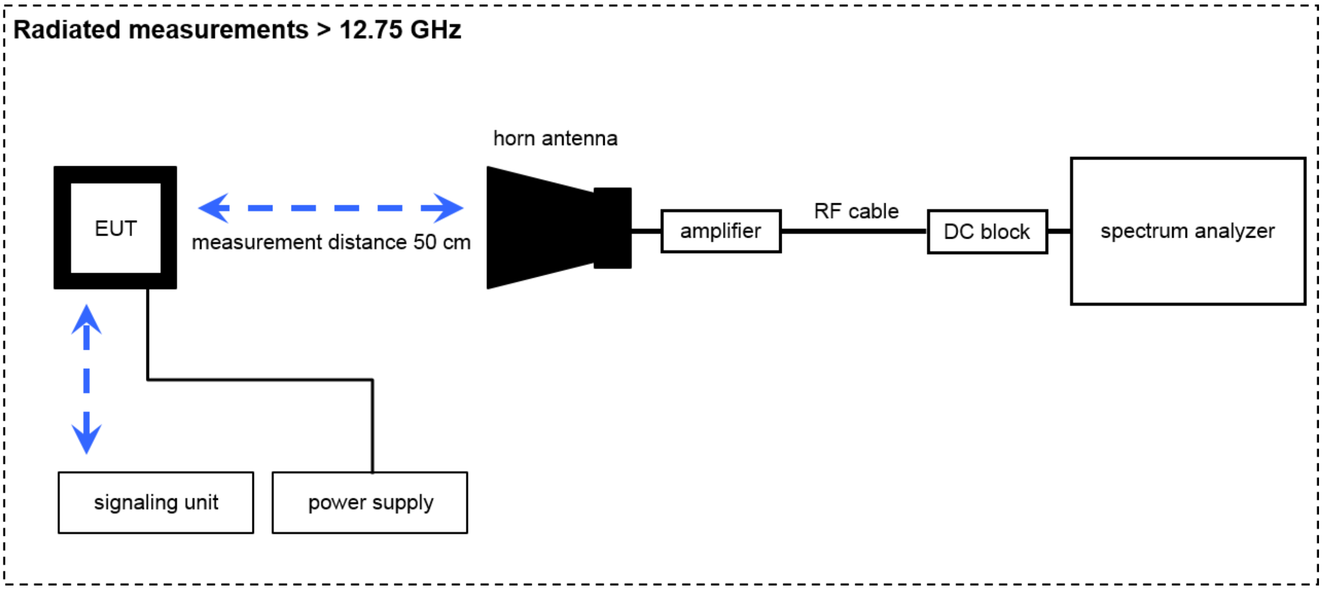
7.2 Radiated measurements fully anechoic chamber



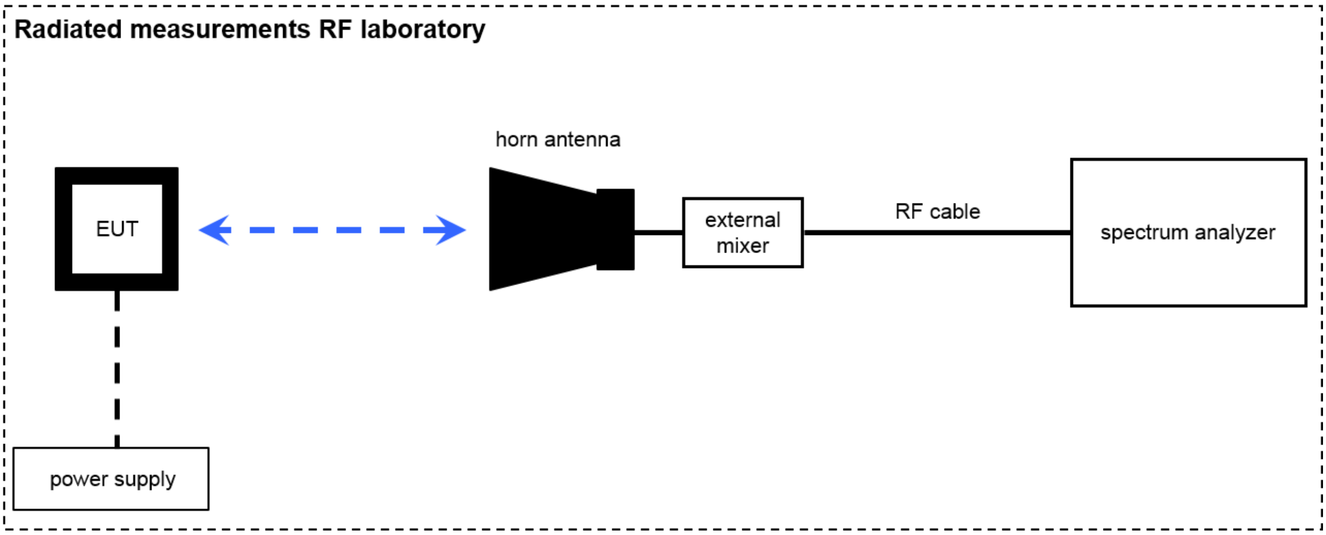
Equipment table (Chamber C):

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	vIKI!	09.12.2020	08.12.2023
2	n. a.	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vIKI!	13.06.2019	12.06.2021
3	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
4	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	371	300003854	vIKI!	14.01.2020	13.01.2022
5	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9709-5289	300000213	vIKI!	14.07.2020	13.07.2022
6	n. a.	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
7	n. a.	Variable isolating transformer	MPL IEC625 Bus Variable isolating transformer	Erfi	91350	300001155	ne	-/-	-/-
8	n. a.	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	11.12.2020	10.12.2021
9	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	19	300003790	ne	-/-	-/-
10	n. a.	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
11	n. a.	Broadband Amplifier 5-13 GHz	CBLU5135235	CERNEX	22010	300004491	ev	-/-	-/-
12	n. a.	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
13	n. a.	NEXIO EMV-Software	BAT EMC V3.16.0.49	EMCO		300004682	ne	-/-	-/-
14	n. a.	PC	ExOne	F+W		300004703	ne	-/-	-/-
15	n. a.	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011572	300005241	ev	-/-	-/-

7.3 Radiated measurements 18 GHz to 50 GHz in test lab

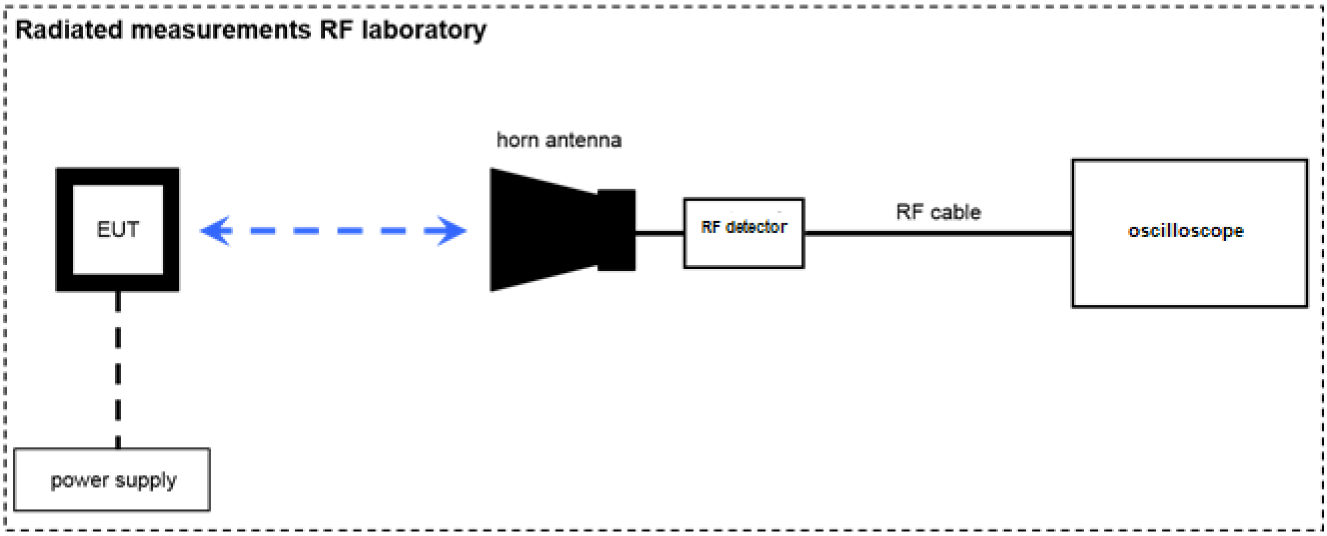


7.4 Radiated measurements > 50 GHz in test lab



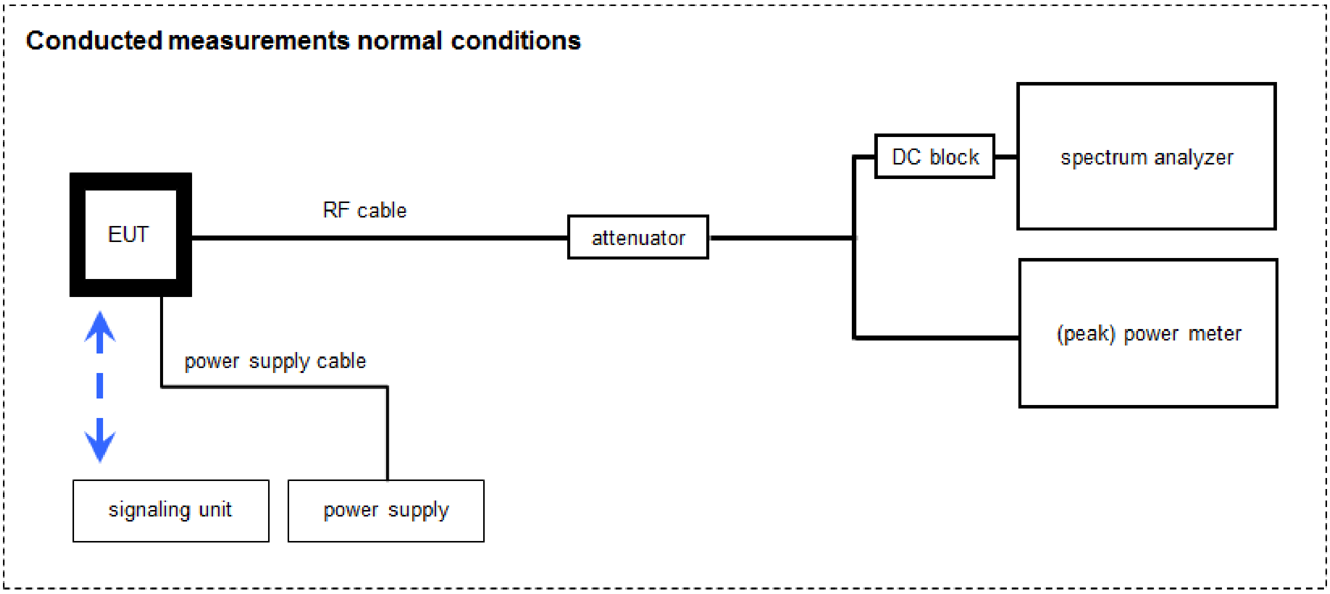
Note: conversion loss of mixer is already included in analyzer value.

7.5 Radiated measurements with RF detector > 50 GHz in test lab



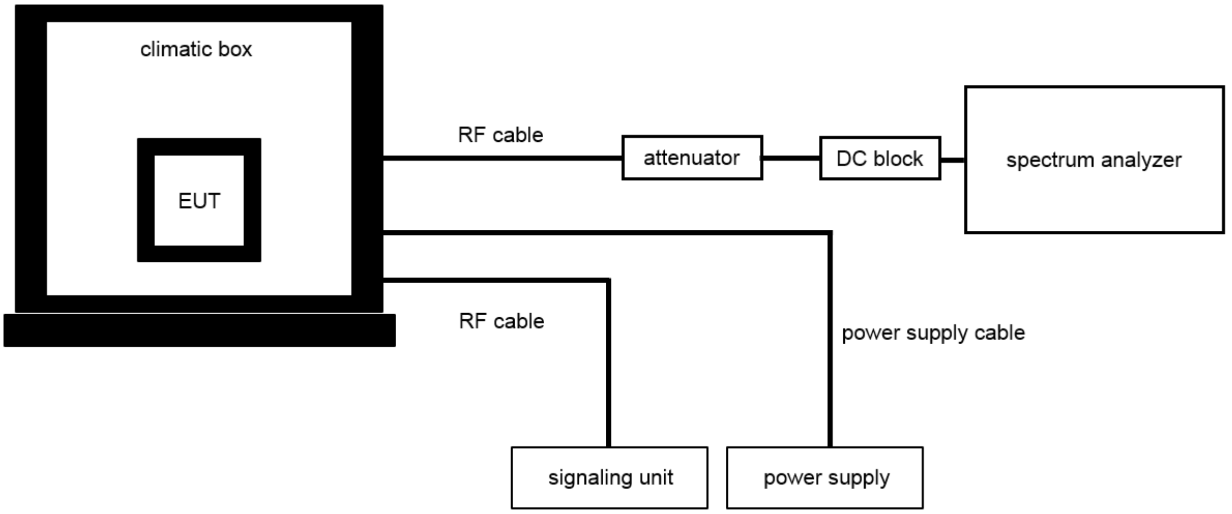
Note: EUT is replaced by reference source for substitution measurement

7.6 Conducted measurements with power meter & spectrum analyzer



7.7 Conducted measurements under extreme conditions (frequency error)

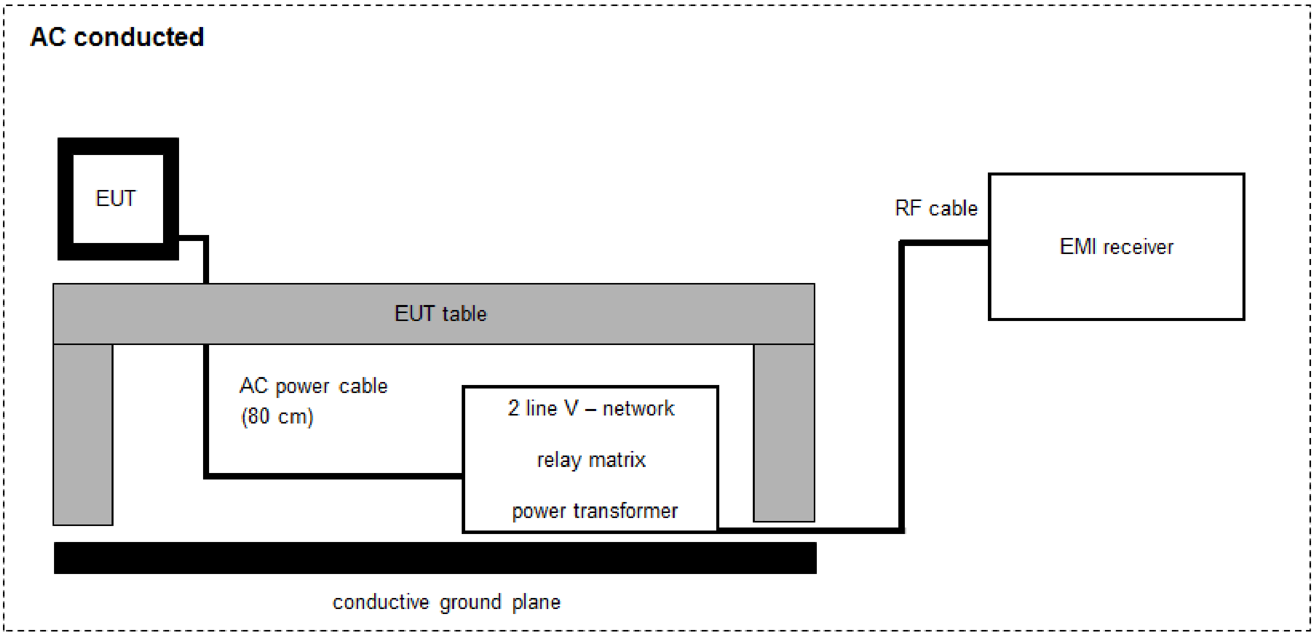
Conducted measurements normal & extreme conditions



Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Std. Gain Horn Antenna 18.0-26.5 GHz	638	Narda		300000486	vlKI!	21.01.2020	20.01.2022
2	n. a.	Std. Gain Horn Antenna 26.5-40.0 GHz	V637	Narda	7911	300001751	ne	23.01.2020	22.01.2022
3	n. a.	Std. Gain Horn Antenna 39.3-59.7 GHz	2424-20	Flann	75	300001979	ne	-/-	-/-
4	n. a.	Std. Gain Horn Antenna 60-90 GHz	COR 60_90	Thomson CSF		300000814	ev	-/-	-/-
5	n. a.	Std. Gain Horn Antenna 73.8-112 GHz	2724-20	Flann	*	300001988	ne	-/-	-/-
6	n. a.	Std. Gain Horn Antenna 114-173 GHz	2924-20	Flann	*	300001999	ne	-/-	-/-
7	n. a.	Std. Gain Horn Antenna 145-220 GHz	3024-20	Flann	*	300002000	ne	-/-	-/-
8	n. a.	Broadband LNA 18-50 GHz	CBL18503070PN	CERNEX	25240	300004948	ev	09.03.2020	08.03.2022
9	n. a.	Harmonic Mixer 3-Port, 75-110 GHz	FS-Z110	R&S	101411	300004959	k	19.06.2020	18.06.2021
10	n. a.	Harmonic Mixer 3-Port, 110-170 GHz	FS-Z170	Radiometer Physics GmbH	100014	300004156	k	28.05.2020	27.05.2021
11	n. a.	Harmonic Mixer 3-Port, 140-220 GHz	SAM-220	Radiometer Physics GmbH	200001	300004157	k	14.07.2020	13.07.2021
12	n. a.	Harmonic Mixer 3-Port, 60-90 GHz	FS-Z90	R&S	101555	300004691	k	08.07.2020	07.07.2021
13	n. a.	Signal- and Spectrum Analyzer 2 Hz - 85 GHz	FSW85	Rohde & Schwarz	101333	300005568	k	17.06.2020	16.06.2021
14	n.a.	Spectrum Analyzer 20 Hz - 50 GHz	FSW50	Rohde & Schwarz	101560	300006179	k	05.03.2021	04.03.2022
15	n.a.	Waveguide, 60.5 to 92.0 GHz, 800 mm	26441-800MM UG387/U-AC	Flann	227502	300004809 -0007	ev	-/-	-/-
16	n.a.	Waveguide, 60.5 to 92.0 GHz, 150 mm	26441-150MM UG387/U-AC	Flann	227499	300004809 -0006	ev	-/-	-/-
17	n.a.	Waveguide Termination 60.5 to 92.0 GHz	26040 UG387/U-AC	Flann	227492	300004809 -0004	ev	-/-	-/-
18	n.a.	Directional Coupler, 3 Port, 10 dB	26136-10	Flann	227494	300004809 -0009	ev	-/-	-/-
19	n.a.	Waveguide Attenuator 10dB, max. 30 dBm	QAF-E20000	Quinstar	1142400028	Customer Property	ev	-/-	-/-
20	n.a.	Waveguide Attenuator 10dB, WR12, 60-90GHz	CAF-1210-S1	Ducommun	1012800-01	300004841	ev	-/-	-/-
21	n.a.	Cable Load Generator	CLGD	Rohde & Schwarz	101576	Property of Rohde & Schwarz	ev	-/-	-/-
22	n.a.	Thermal Power Sensor, DC-110GHz, 300nW-100mW	NRP-Z58	Rohde & Schwarz	100913	300004808	k	07.01.2020	06.01.2022
23	n.a.	Power Meter	NRP	Rohde & Schwarz	100212	300003780	k	11.12.2019	10.12.2021
24	n.a.	Impedance Matching Pad	AIR IMP1-N50-75F	AIR	n.a.	Customer Property	ev	-/-	-/-
25	n.a.	SG Extension Module 50 – 75 GHz	E8257DV15	VDI	US54250124	300005541	ev	-/-	-/-
26	n.a.	Std. Gain Horn Antenna 50-75 GHz	COR 50_75	Thomson CSF		300000813	ev	-/-	-/-
27	n.a.	Std. Gain Horn Antenna 50-75 GHz, 25 dBi	25240-25	Flann	107	300002699	ev	-/-	-/-
28	n.a.	RF Detector	SFD-503753-15SF-P1	Eravant	07353-1	300006118	ev	-/-	-/-
29	n.a.	Oscilloscope	DPO7254	Tektronix	B022702	300003573	k	07.12.2020	05.12.2022

7.8 AC power-line conducted emissions



FS = UR + CF + VC
(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

Example calculation:
FS [dBµV/m] = 37.62 [dBµV/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dBµV/m] (244.06 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	-/-	Two-line V-Network (LISN) 9 kHz to 30 MHz	ESH3-Z5	R&S	892475/017	300002209	vIKI!	11.12.2019	10.12.2021
2	-/-	RF-Filter-section	85420E	HP	3427A00162	300002214	NK!	-/-	-/-
3	-/-	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	09.12.2020	08.12.2021
4	-/-	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	-/-	-/-

8 Measurement uncertainty

Measurement uncertainty	
Test case	**Uncertainty**
Spectrum bandwidth	span/1000
Output power	± 3 dB
Spurious emissions radiated below 30 MHz	± 3 dB
Spurious emissions radiated 30 MHz to 1 GHz	± 3 dB
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3.7 dB
Spurious emissions radiated above 12.75 GHz	± 4.5 dB
DC and low frequency voltages	± 3 %
Temperature	± 1 °C
Humidity	± 3 %

9 Far field consideration for measurements above 18 GHz

Far field distance calculation:

$D_{ff} = 2 \times D^2 / \lambda$

with
D_{ff} Far field distance
D Antenna dimension
λ wavelength

Spurious emission measurements:

Antenna frequency range in GHz	Highest measured frequency in GHz	D in cm	λ in cm	D_{ff} in cm
18-26	26	3.4	1.15	20.04
26-40	40	2.2	0.75	12.91
40-50	50	2.77	0.60	25.58
50-75	75	1.85	0.40	17.11
75-110	110	1.24	0.27	11.28
110-170	170	0.85	0.18	8.19
170-220	220	0.68	0.14	6.78

In band measurement (EIRP, OBW):

Antenna frequency range in GHz	Highest measured frequency in GHz	Antenna dimension in cm	Wavelength in cm	far field distance in cm
50-75	71	5	0.46	116

10 Measurement results

10.1 Summary

☒	**No deviations from the technical specifications were ascertained**
☐	There were deviations from the technical specifications ascertained
☐	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC identifier	Description	verdict	date	Remark
RF-Testing	FCC 47 CFR Part 15 IC RSS-210 Issue 10 IC RSS-Gen Issue 5	see below	2021-07-13	-/-

Test specification clause	Test case	Temperature conditions	Power supply	Pass	Fail	NA	NP	Results (max.)
§15.215 RSS-Gen 6.7	Occupied bandwidth	Nominal	Nominal	☒	☐	☐	☐	complies
§15.255(e) RSS-210 J.4	Maximum conducted output power	Nominal	Nominal	☒	☐	☐	☐	complies
§15.255(a) / (c) (1) (i) RSS-210 J.2.2	Maximum E.I.R.P.	Nominal	Nominal	☒	☐	☐	☐	**complies)***
§15.255(d) RSS-210 J.3	Spurious Emissions	Nominal	Nominal	☒	☐	☐	☐	complies
§15.255(f) RSS-210 J.6	Frequency stability	Extreme Nominal	Extreme Nominal	☒	☐	☐	☐	complies
§15.255(h) RSS-210 J.7	Beamforming	Nominal	Nominal	☐	☐	☒	☐	--

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

) *
at maximum input level of -2 dBm at each of the single downlink transmitter units when operated at full band use of 500 MHz for each of the three transmitters. (see section 11.3 for details)

11 Measurement results

11.1 Occupied bandwidth (99%, 20 dB Bandwidth)

Description:

Measurement of the Bandwidth of the wanted signal.

Measurement:

Measurement parameter	
Detector:	Pos-Peak
Sweep time:	10 s
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	See plot
Trace-Mode:	Max Hold

Limits:

FCC	IC
CFR Part 15.255	RSS-Gen 6.7
The occupied bandwidth from intentional radiators operated within the specified frequency band shall comply with the following:	
Frequency range	
57 GHz – 71 GHz	

Measurement results:

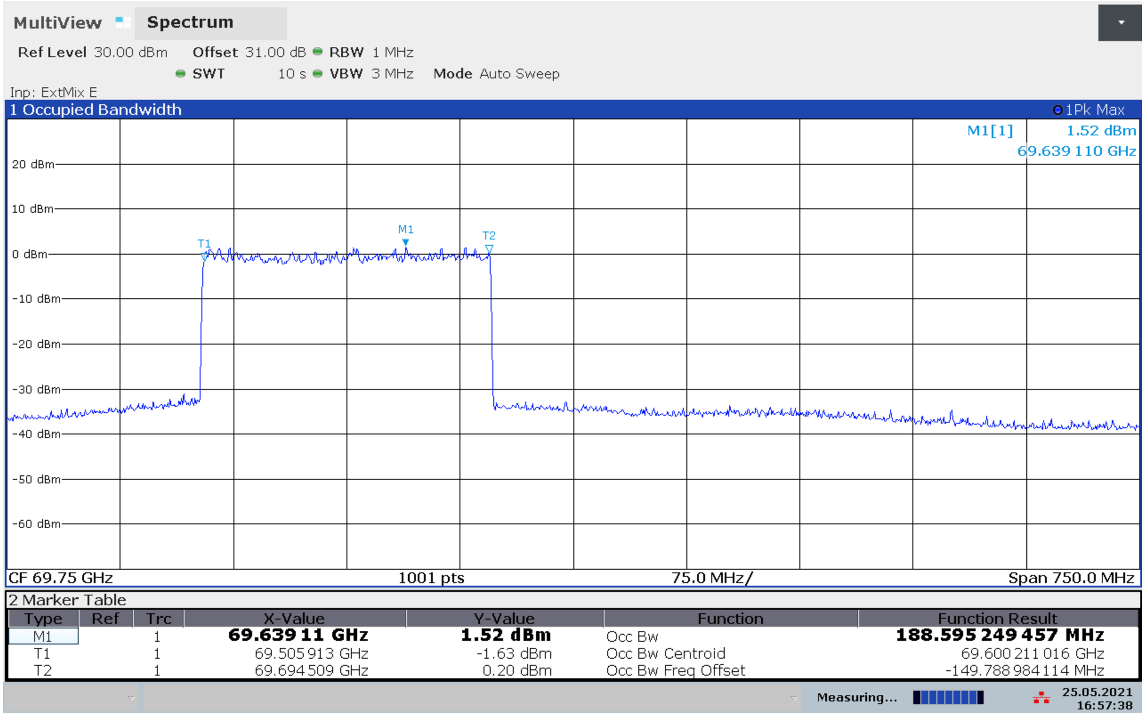
Test condition T_{nom} / V_{nom}	Frequency band	bandwith	Position	F_L in GHz	F_H in GHz	Occupied bandwidth in MHz
99% OBW	69.5 – 70.0 GHz	192 MHz	low	69.505 913	69.694 509	188.595
99% OBW	69.5 – 70.0 GHz	192 MHz	mid	69.655 880	69.844 326	188.445
99% OBW	69.5 – 70.0 GHz	192 MHz	high	69.805 586	69.993 299	187.713
99% OBW	69.5 – 70.0 GHz	96 MHz	low	69.502 237	69.597 582	96.345
99% OBW	69.5 – 70.0 GHz	96 MHz	mid	69.702 212	69.797 569	95.356
99% OBW	69.5 – 70.0 GHz	96 MHz	high	69.902 008	69.997 278	95.269
99% OBW	70.0 – 70.5 GHz	192 MHz	low	70.006 342	70.194 273	187.930
99% OBW	70.0 – 70.5 GHz	192 MHz	mid	70.155 400	70.344 668	189.267
99% OBW	70.0 – 70.5 GHz	192 MHz	high	70.805 513	70.992 441	186.927
99% OBW	70.0 – 70.5 GHz	96 MHz	low	70.002 213	70.097 738	95.525
99% OBW	70.0 – 70.5 GHz	96 MHz	mid	70.202 005	70.297 564	95.558
99% OBW	70.0 – 70.5 GHz	96 MHz	high	70.401 905	70.497 044	95.139
99% OBW	70.5 – 71.0 GHz	192 MHz	low	70.506 229	70.694 546	188.317
99% OBW	70.5 – 71.0 GHz	192 MHz	mid	70.655 874	70.844 245	188.371
99% OBW	70.5 – 71.0 GHz	192 MHz	high	70.805 513	70.992 441	186.927
99% OBW	70.5 – 71.0 GHz	96 MHz	low	70.502 580	70.597 569	94.989
99% OBW	70.5 – 71.0 GHz	96 MHz	mid	70.702 163	70.797 497	95.336
99% OBW	70.5 – 71.0 GHz	96 MHz	high	70.901 972	70.996 698	94.727
20 dB OBW	69.5 – 70.0 GHz	192 MHz	low	69.503 500	69.696 050	192.560
20 dB OBW	69.5 – 70.0 GHz	192 MHz	mid	69.654 100	69.845 900	191.810
20 dB OBW	69.5 – 70.0 GHz	192 MHz	high	69.803 950	69.995 750	191.810
20 dB OBW	69.5 – 70.0 GHz	96 MHz	low	69.501 050	69.598 950	97.900
20 dB OBW	69.5 – 70.0 GHz	96 MHz	mid	69.701 050	69.798 950	97.900
20 dB OBW	69.5 – 70.0 GHz	96 MHz	high	69.901 050	69.998 950	97.900
20 dB OBW	70.0 – 70.5 GHz	192 MHz	low	70.003 500	70.196 050	192.560
20 dB OBW	70.0 – 70.5 GHz	192 MHz	mid	70.154 100	70.345 900	191.810
20 dB OBW	70.0 – 70.5 GHz	192 MHz	high	70.303 950	70.495 750	191.810
20 dB OBW	70.0 – 70.5 GHz	96 MHz	low	70.001 050	70.098 950	97.900
20 dB OBW	70.0 – 70.5 GHz	96 MHz	mid	70.201 050	70.298 950	97.900
20 dB OBW	70.0 – 70.5 GHz	96 MHz	high	70.401 050	70.498 950	97.900
20 dB OBW	70.5 – 71.0 GHz	192 MHz	low	70.504 250	70.696 050	191.810
20 dB OBW	70.5 – 71.0 GHz	192 MHz	mid	70.654 100	70.845 900	191.810
20 dB OBW	70.5 – 71.0 GHz	192 MHz	high	70.803 950	70.995 750	191.810
20 dB OBW	70.5 – 71.0 GHz	96 MHz	low	70.501 250	70.598 650	97.400
20 dB OBW	70.5 – 71.0 GHz	96 MHz	mid	70.700 550	70.799 450	98.900
20 dB OBW	70.5 – 71.0 GHz	96 MHz	high	70.901 050	70.998 450	97.400
Measurement uncertainty				± span/1000		

Note: Occupied bandwidth measurements show the 192/96 MHz nominal bandwidth of the DOCSIS input signal generated by the R&S CLCD.

Result: The measurement is passed.

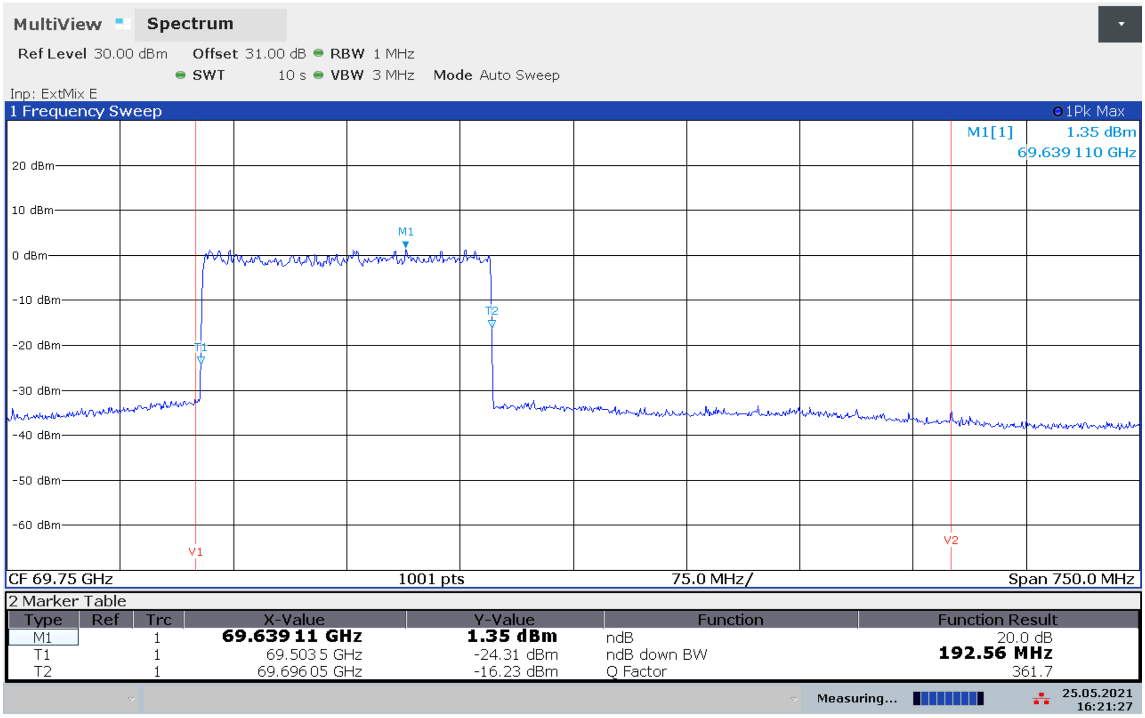
Low Band – Low band edge – 192 MHz

Plot 1: 99% OBW



16:57:38 25.05.2021

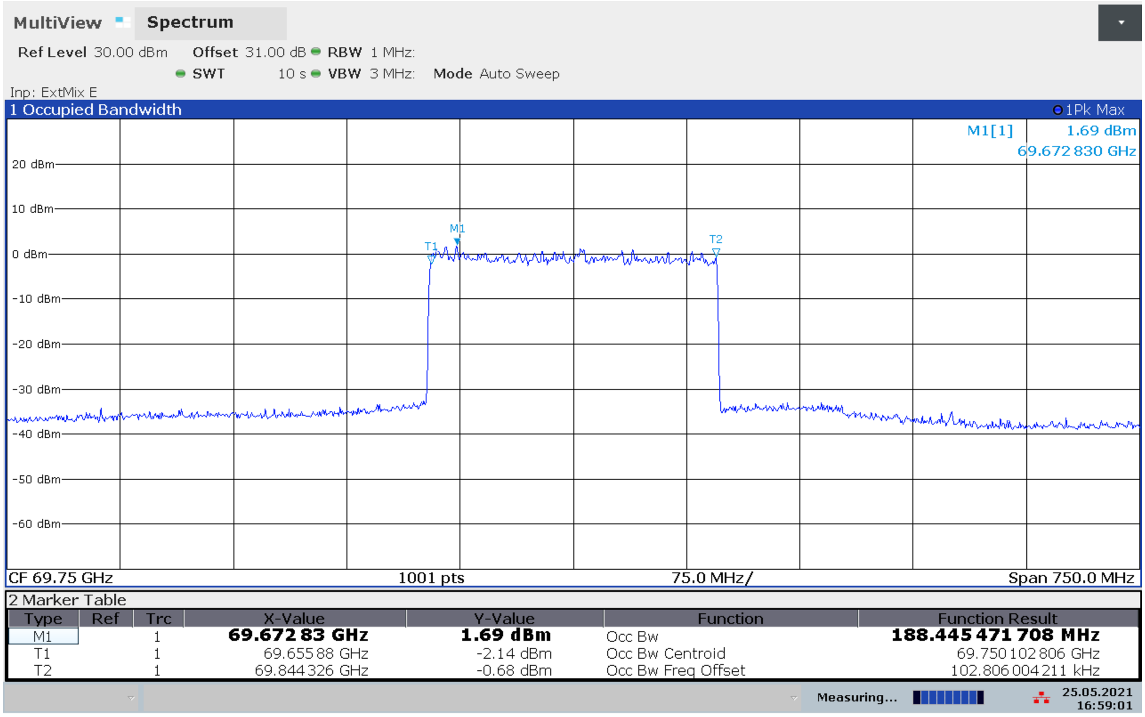
Plot 2: 20 dB OBW



16:21:27 25.05.2021

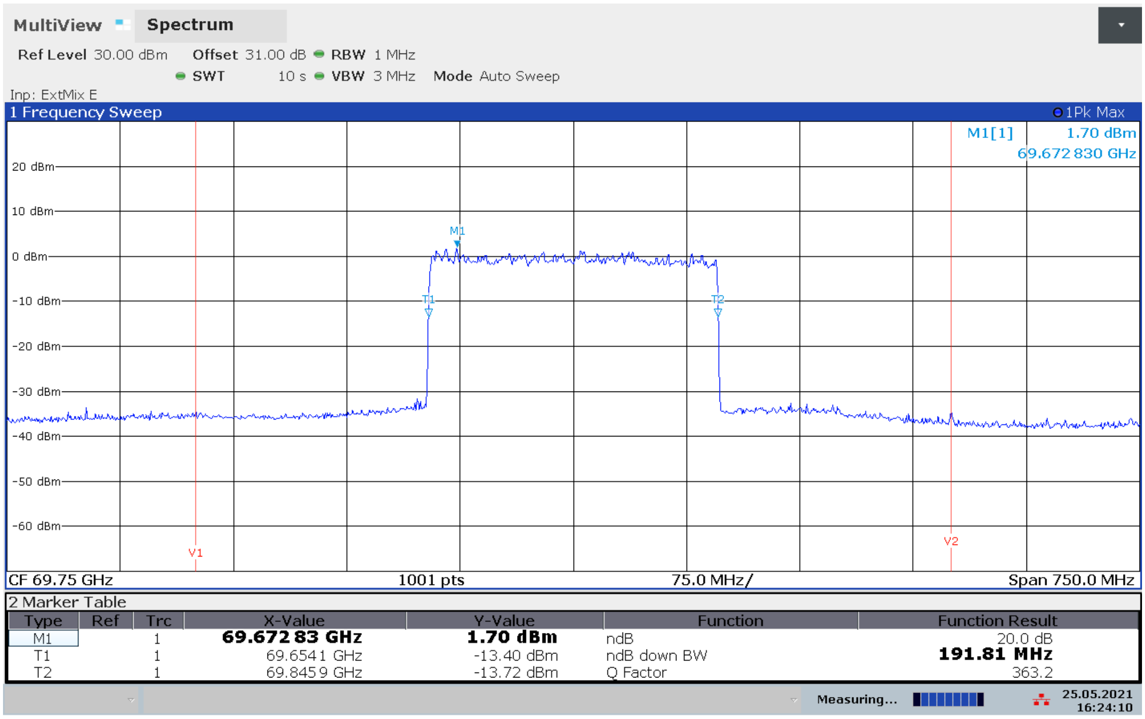
Low Band – Mid band – 192 MHz

Plot 3: 99% OBW



16:59:01 25.05.2021

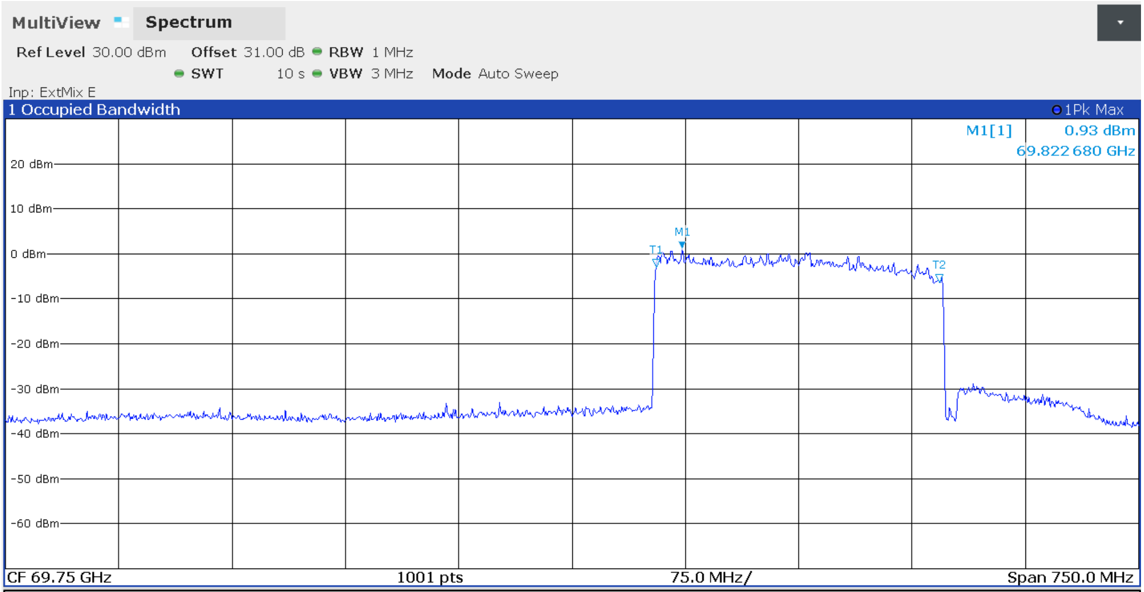
Plot 4: 20 dB OBW



16:24:10 25.05.2021

Low Band – High band edge – 192 MHz

Plot 5: 99% OBW



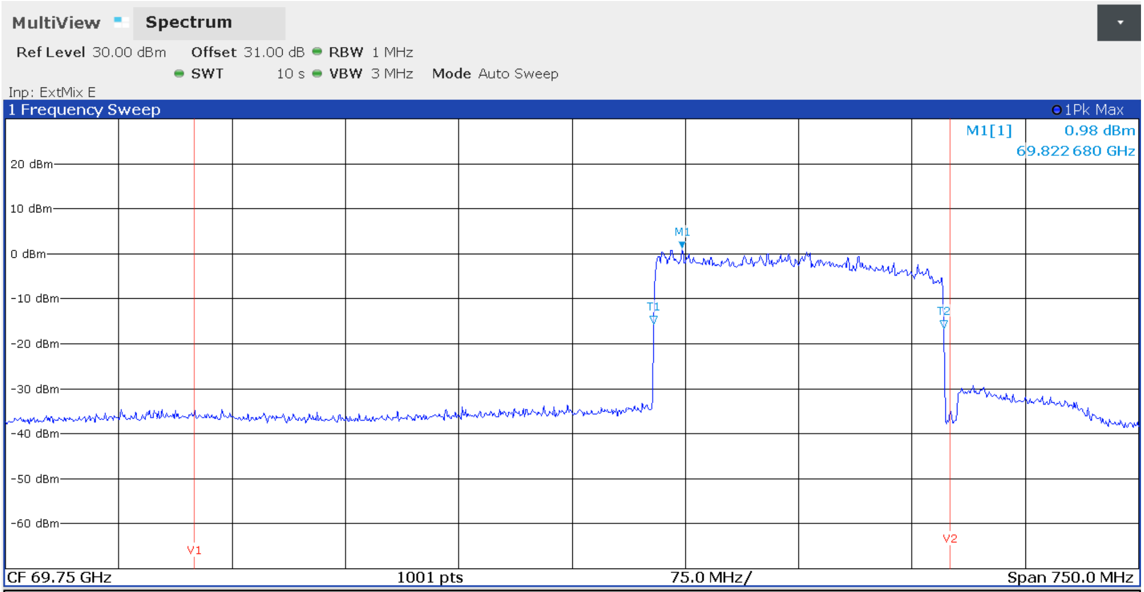
2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**69.822 68 GHz**	**0.93 dBm**	Occ Bw	**187.713 199 446 MHz**
T1		1	69.805 586 GHz	-2.98 dBm	Occ Bw Centroid	69.899 442 235 GHz
T2		1	69.993 299 GHz	-6.27 dBm	Occ Bw Freq Offset	149.442 235 312 MHz

Measuring... 25.05.2021 17:00:11

17:00:11 25.05.2021

Plot 6: 20 dB OBW



2 Marker Table

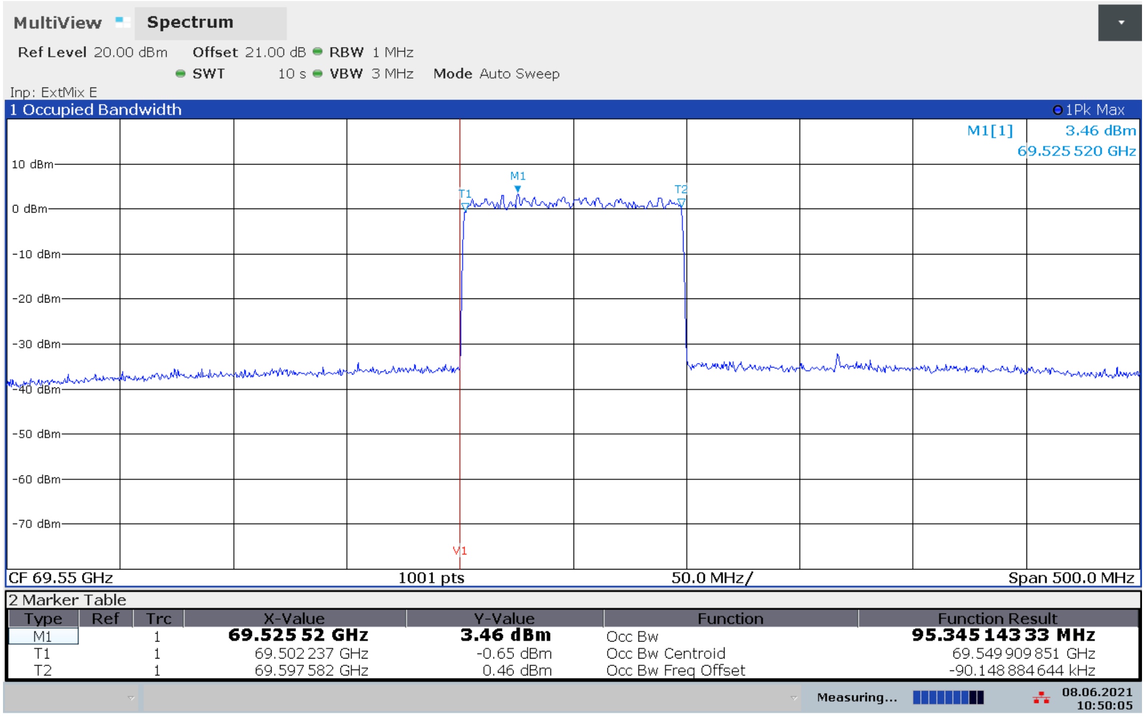
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**69.822 68 GHz**	**0.98 dBm**	ndB	20.0 dB
T1		1	69.803 95 GHz	-15.62 dBm	ndB down BW	**191.81 MHz**
T2		1	69.995 75 GHz	-16.67 dBm	Q Factor	364.0

Measuring... 25.05.2021 16:25:30

16:25:30 25.05.2021

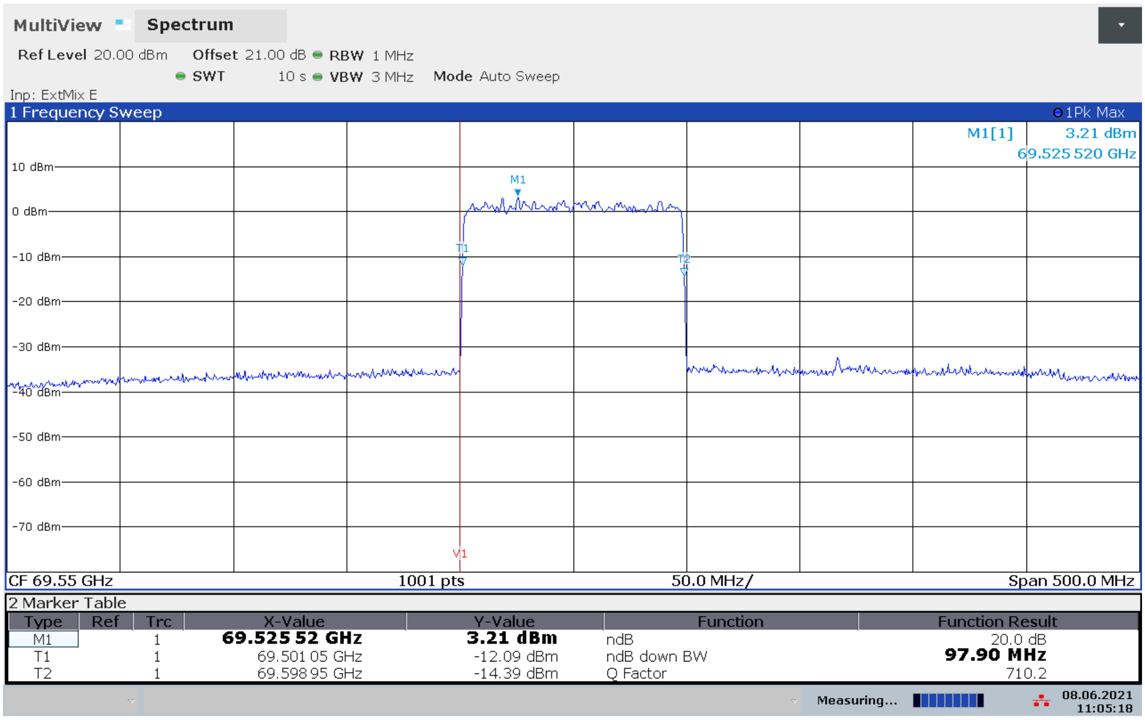
Low Band – Low band edge – 96 MHz

Plot 7: 99% OBW



10:50:05 08.06.2021

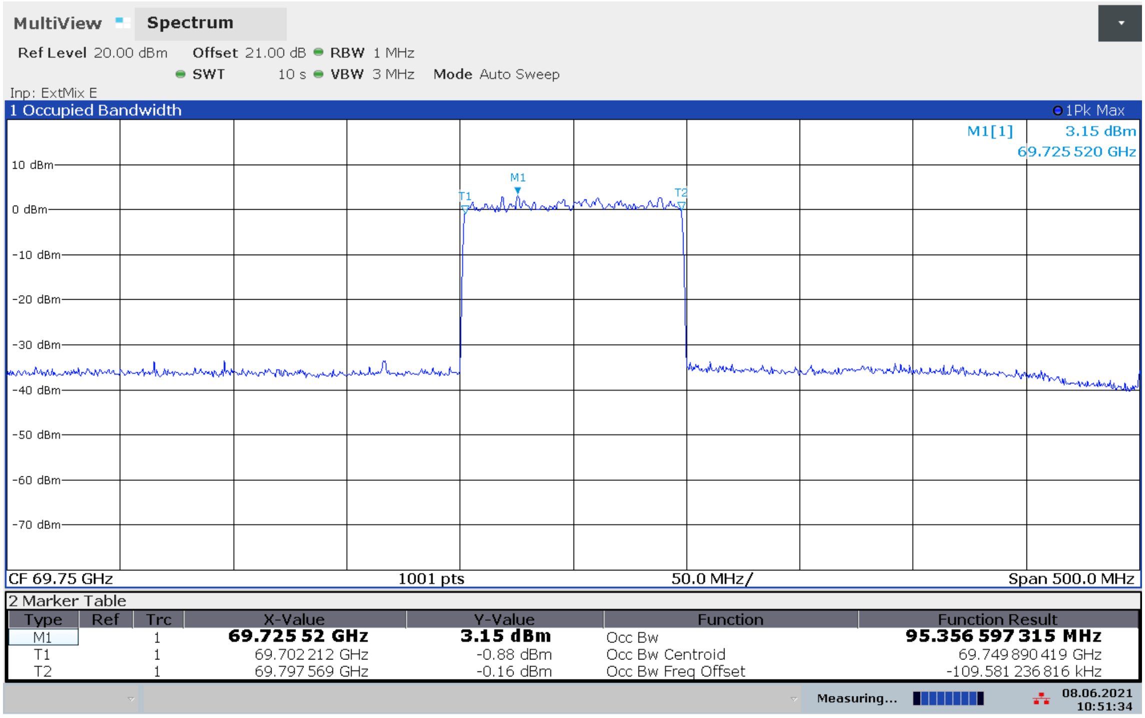
Plot 8: 20 dB OBW



11:05:19 08.06.2021

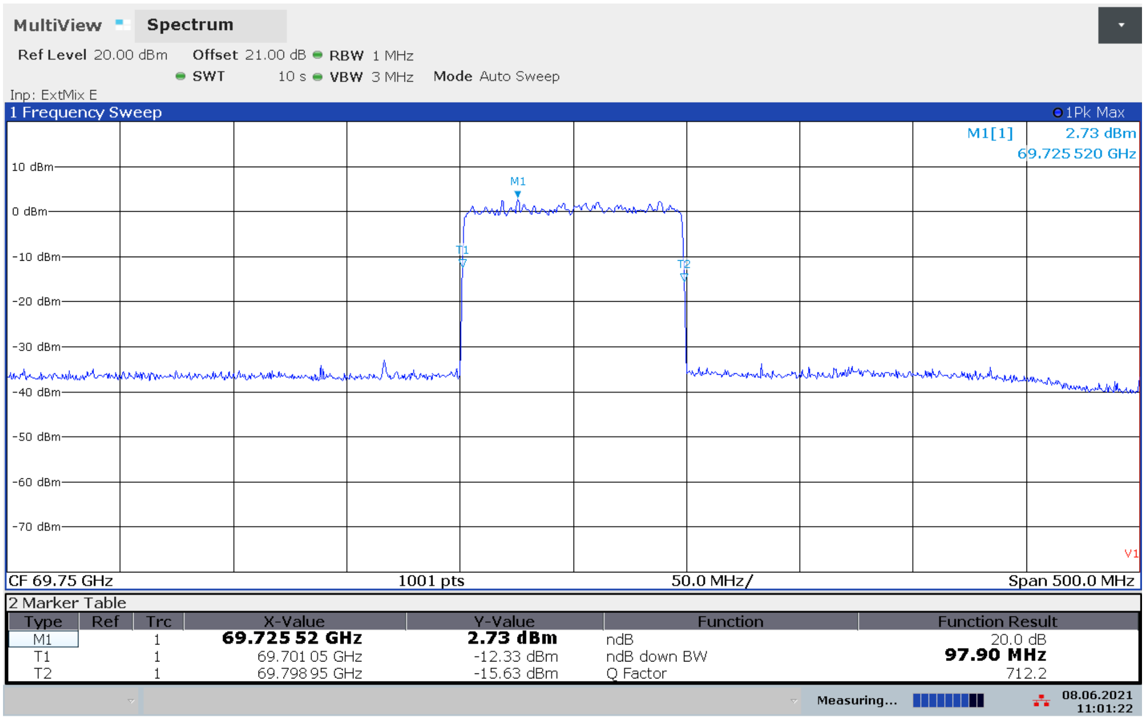
Low Band – Mid band – 96 MHz

Plot 9: 99% OBW



10:51:35 08.06.2021

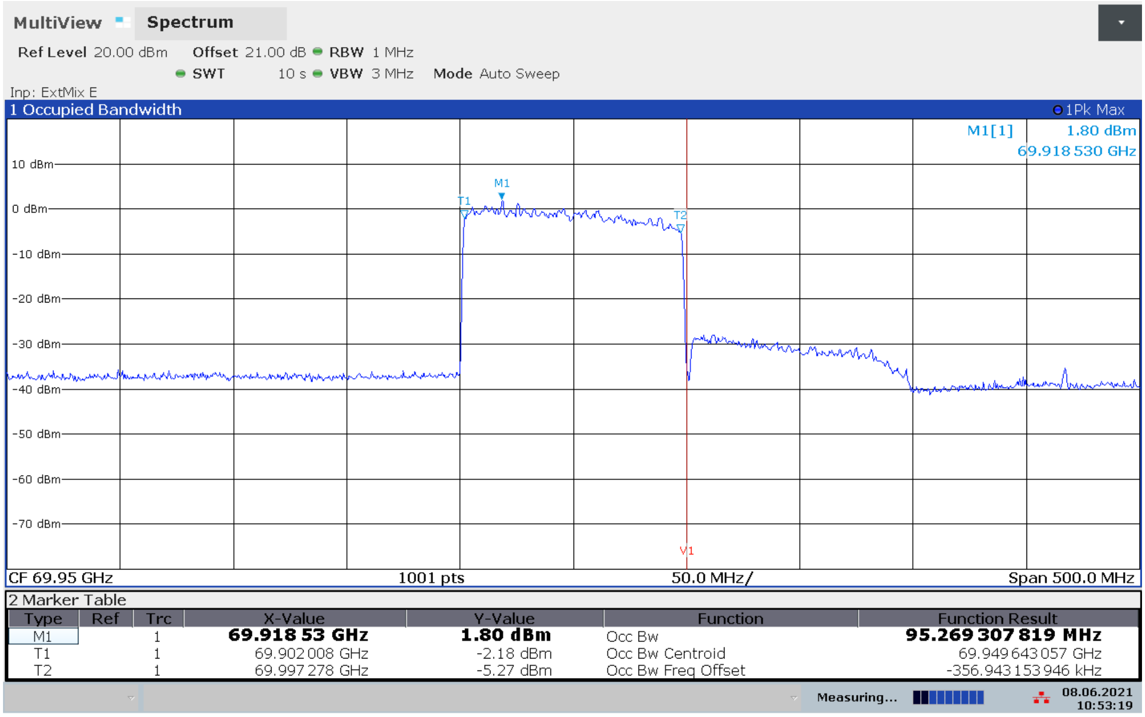
Plot 10: 20 dB OBW



11:01:22 08.06.2021

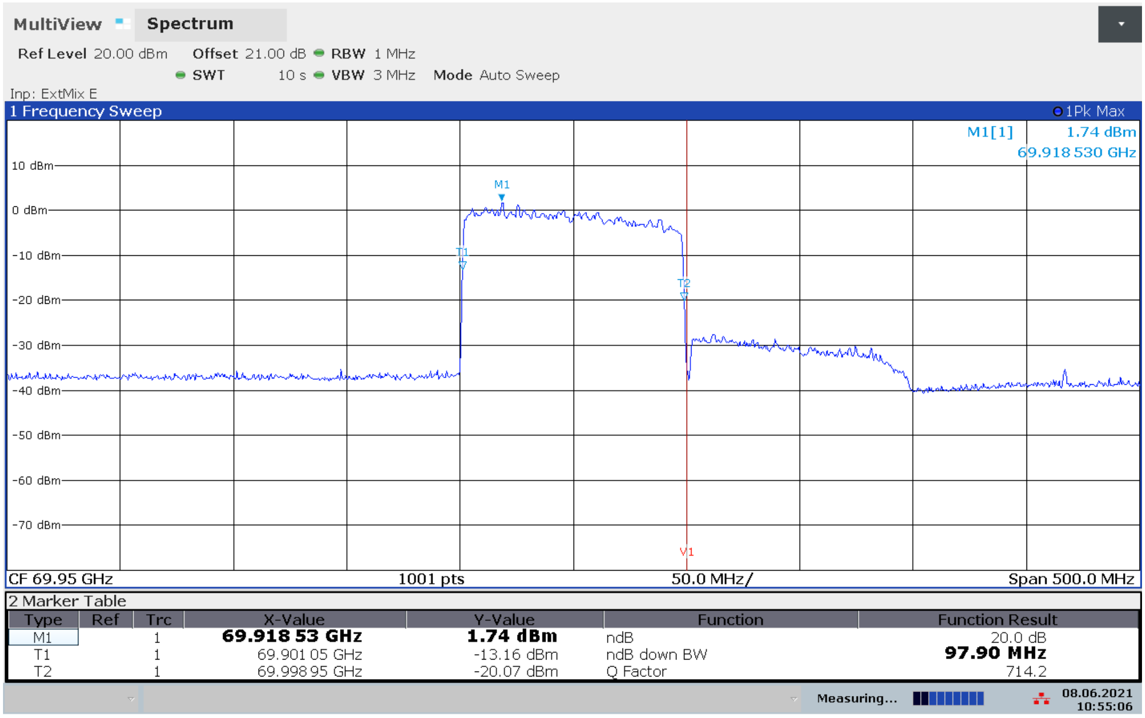
Low Band – High band edge – 96 MHz

Plot 11: 99% OBW



10:53:20 08.06.2021

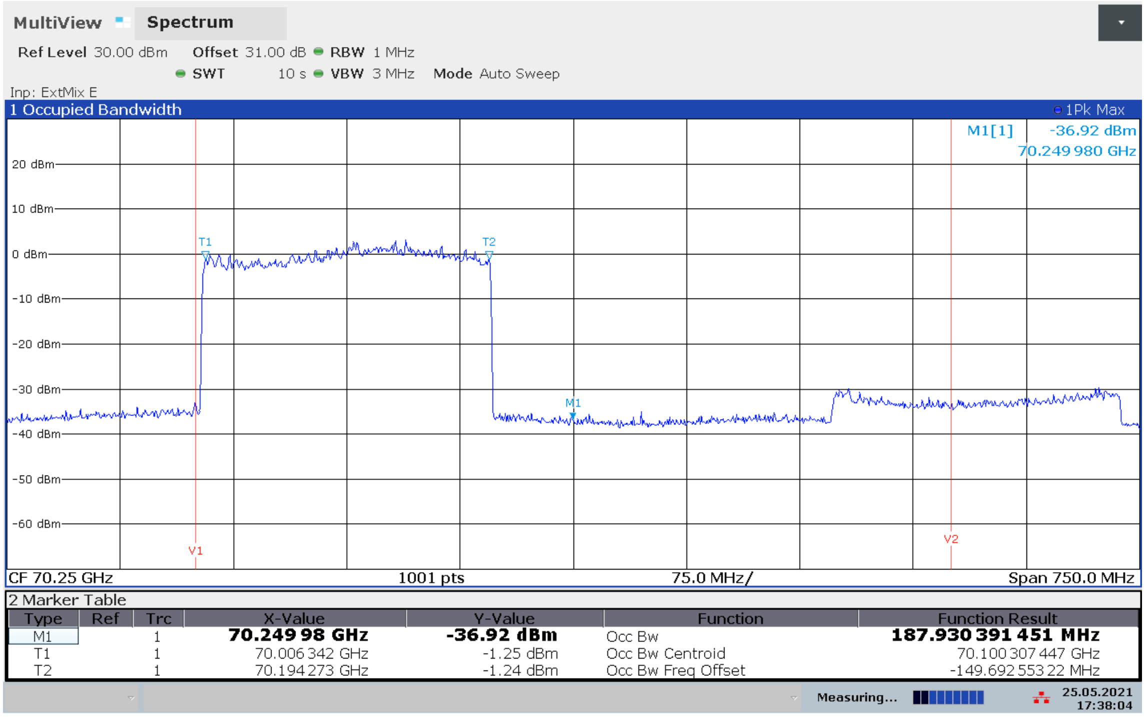
Plot 12: 20 dB OBW



10:55:07 08.06.2021

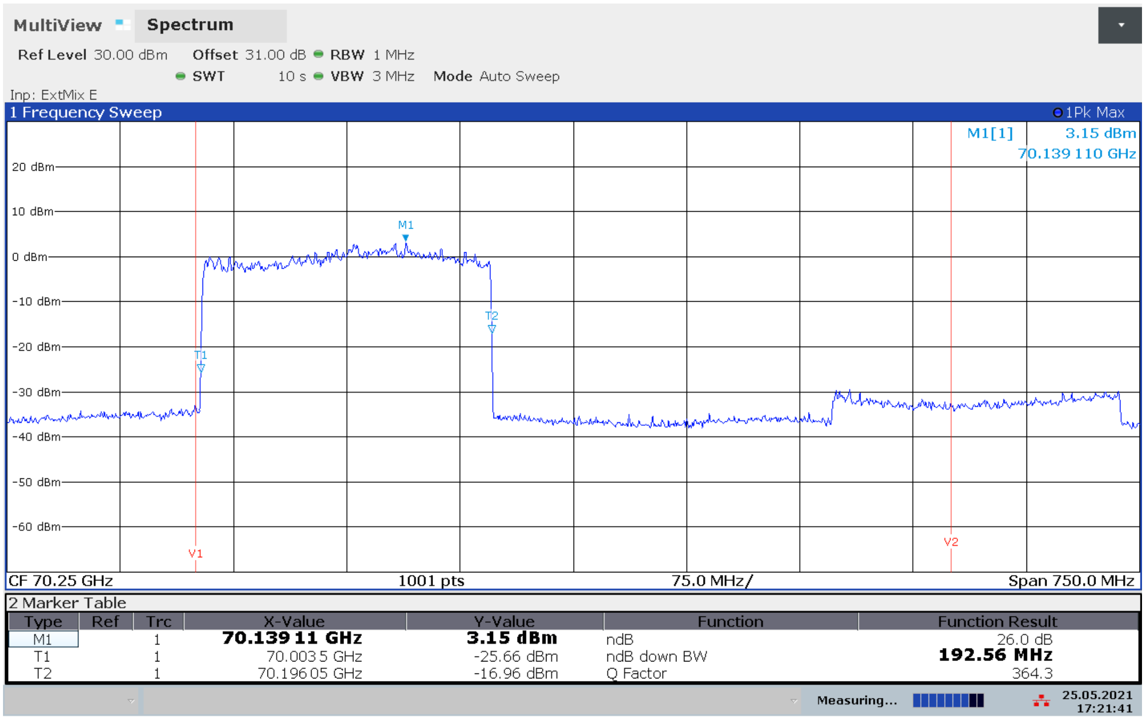
Middle Band – Low band edge – 192 MHz

Plot 13: 99% OBW



17:38:04 25.05.2021

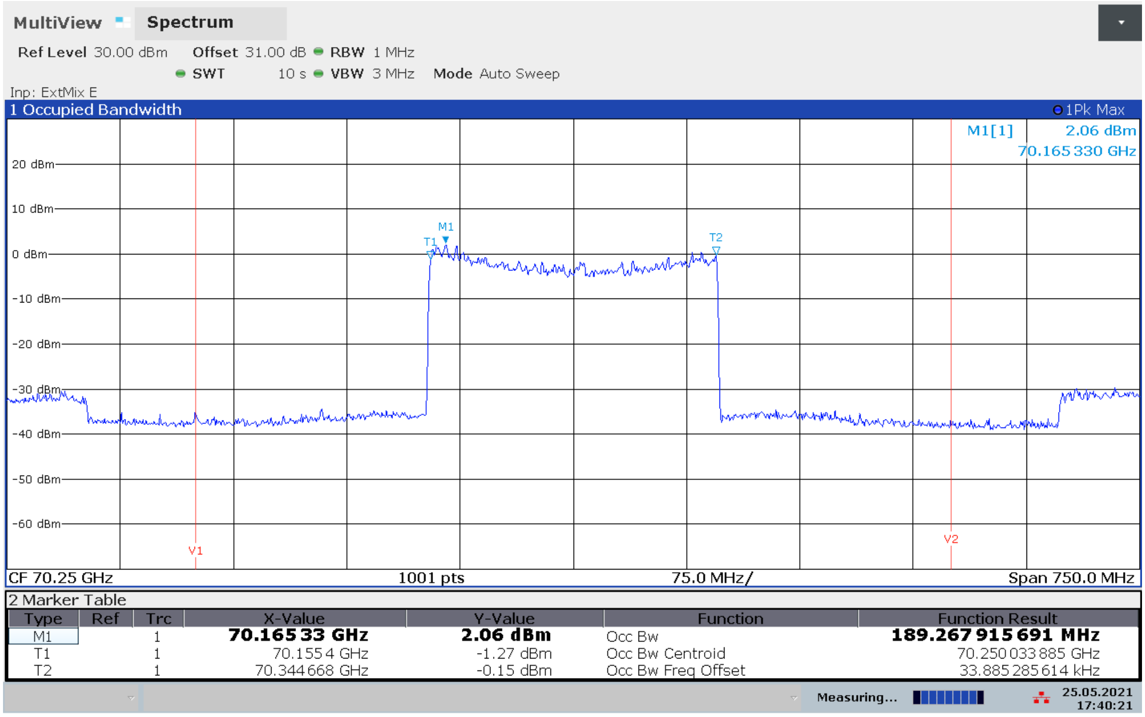
Plot 14: 20 dB OBW



17:21:41 25.05.2021

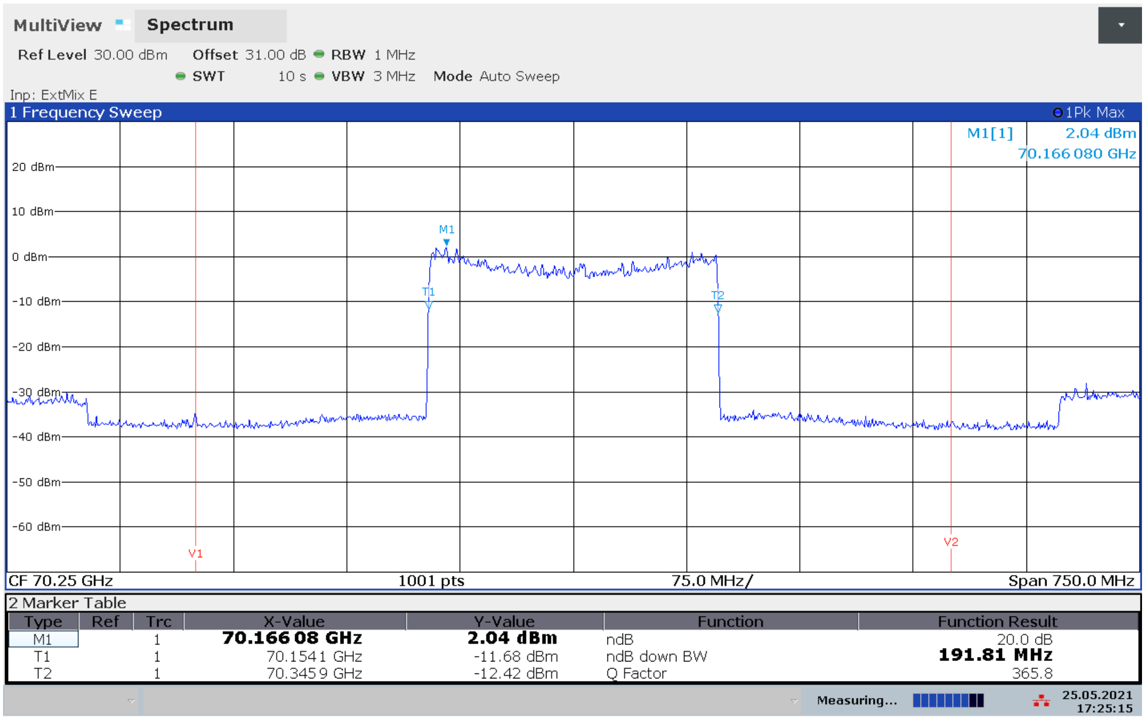
Middle Band – Mid band – 192 MHz

Plot 15: 99% OBW



17:40:22 25.05.2021

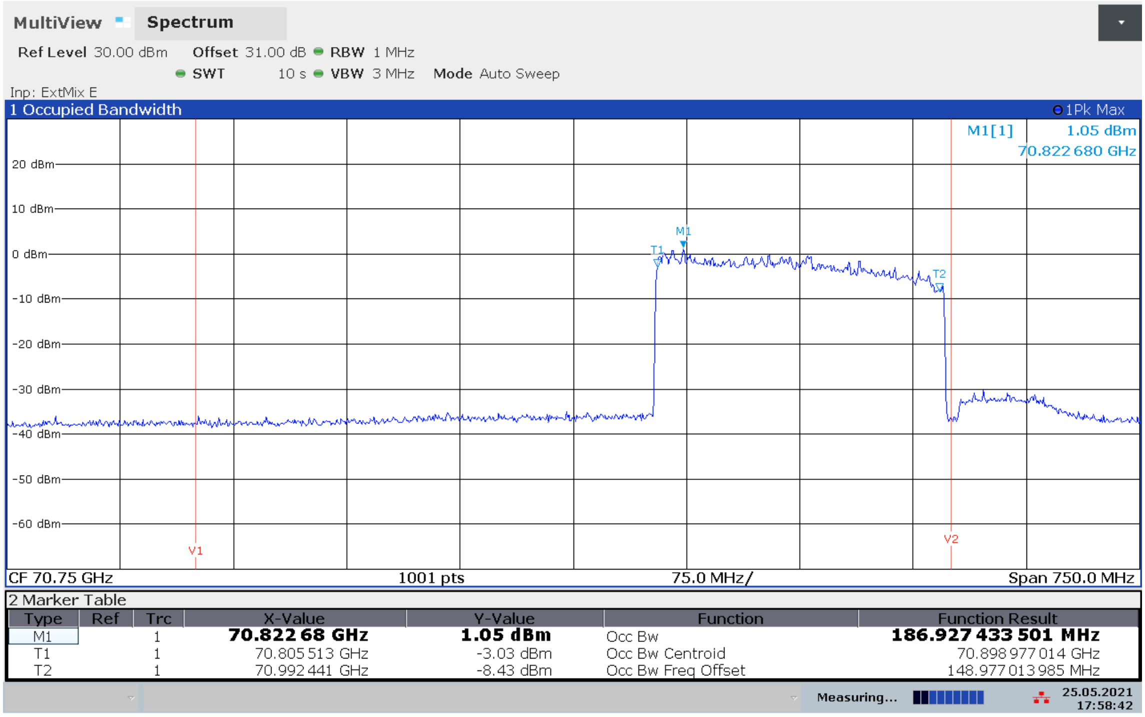
Plot 16: 20 dB OBW



17:25:16 25.05.2021

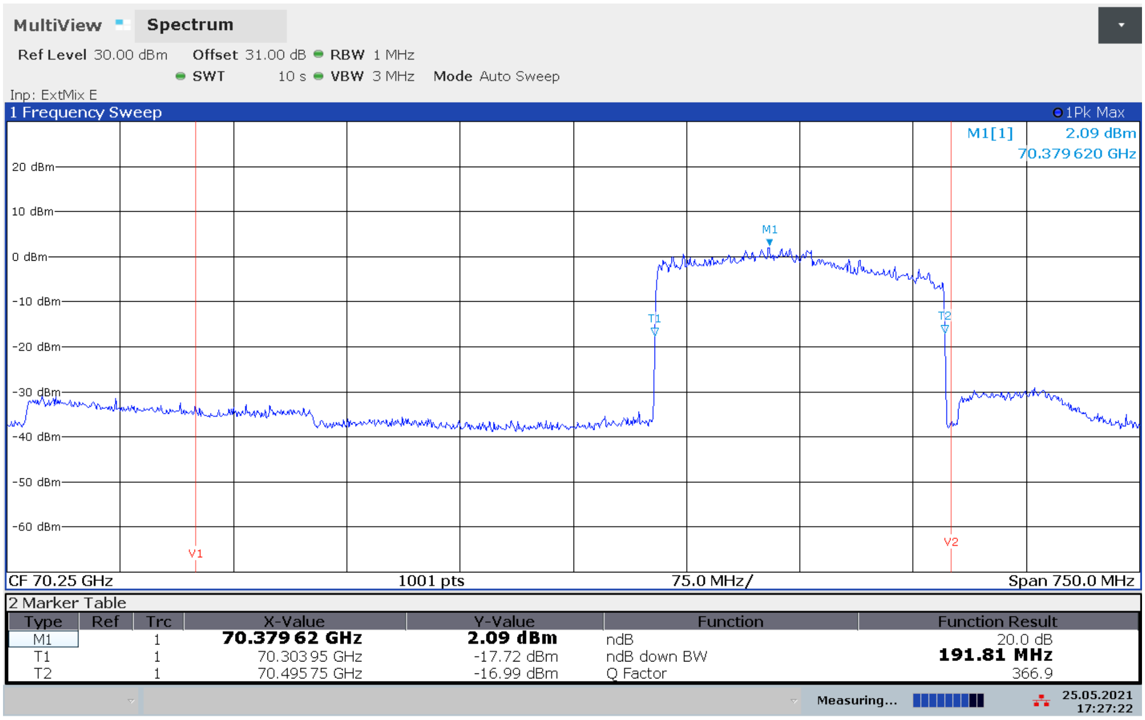
Middle Band – High band edge – 192 MHz

Plot 17: 99% OBW



17:58:43 25.05.2021

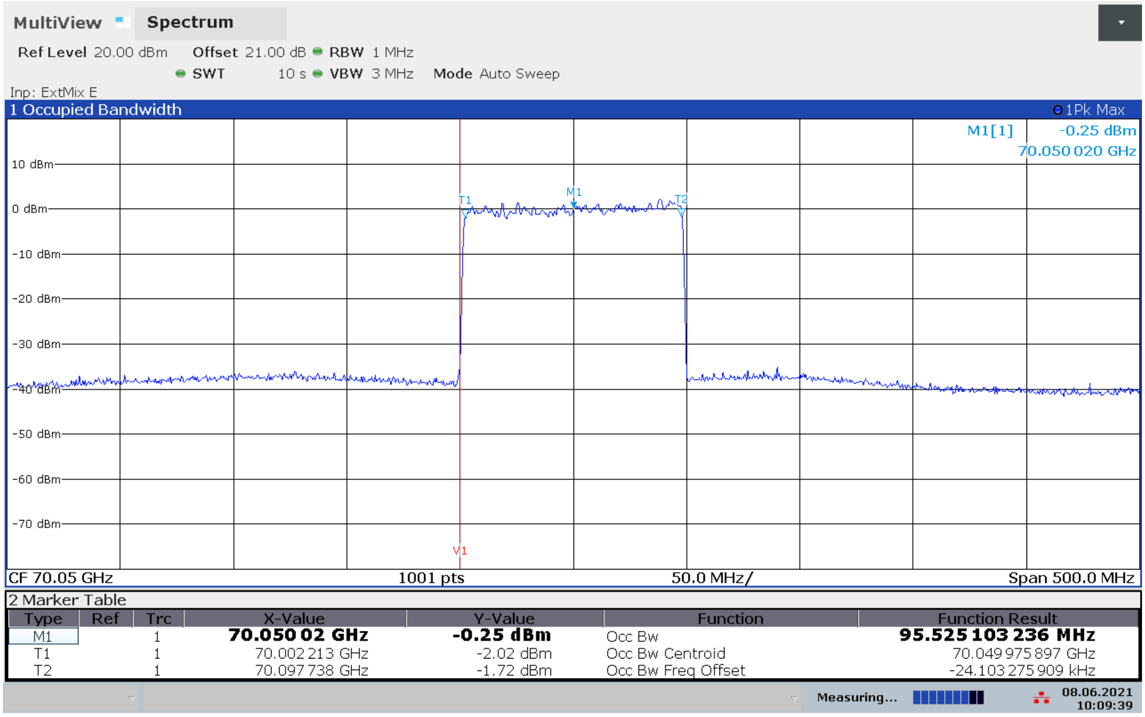
Plot 18: 20 dB OBW



17:27:22 25.05.2021

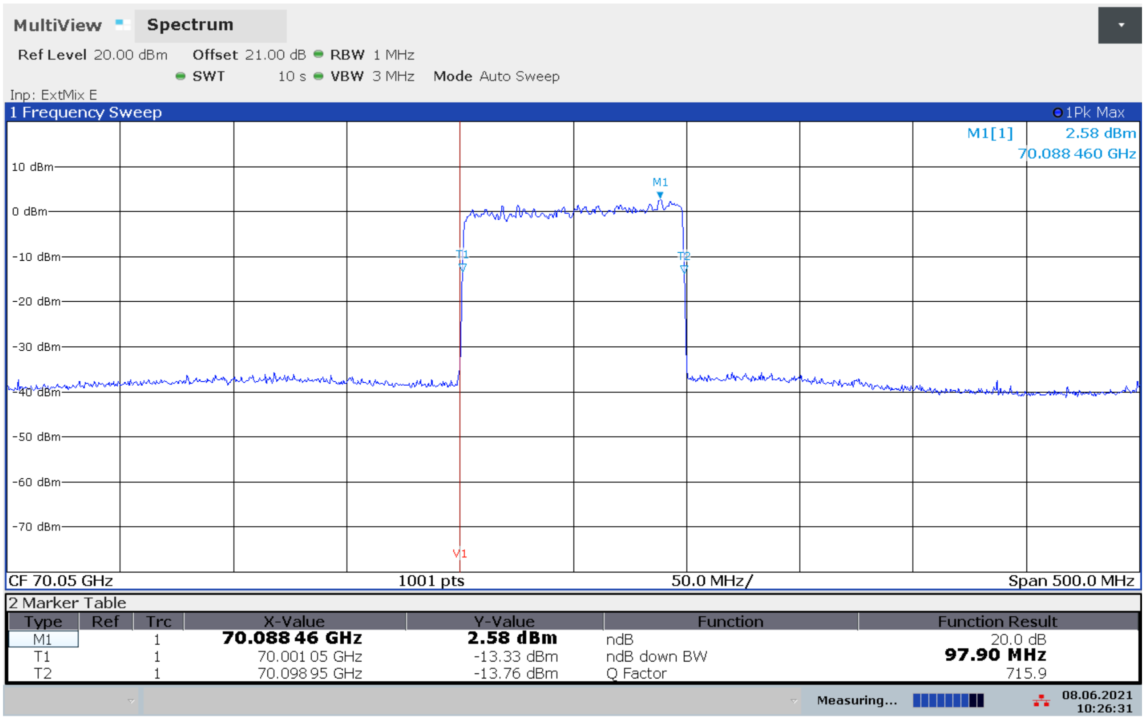
Middle Band – Low band edge – 96 MHz

Plot 19: 99% OBW



10:09:40 08.06.2021

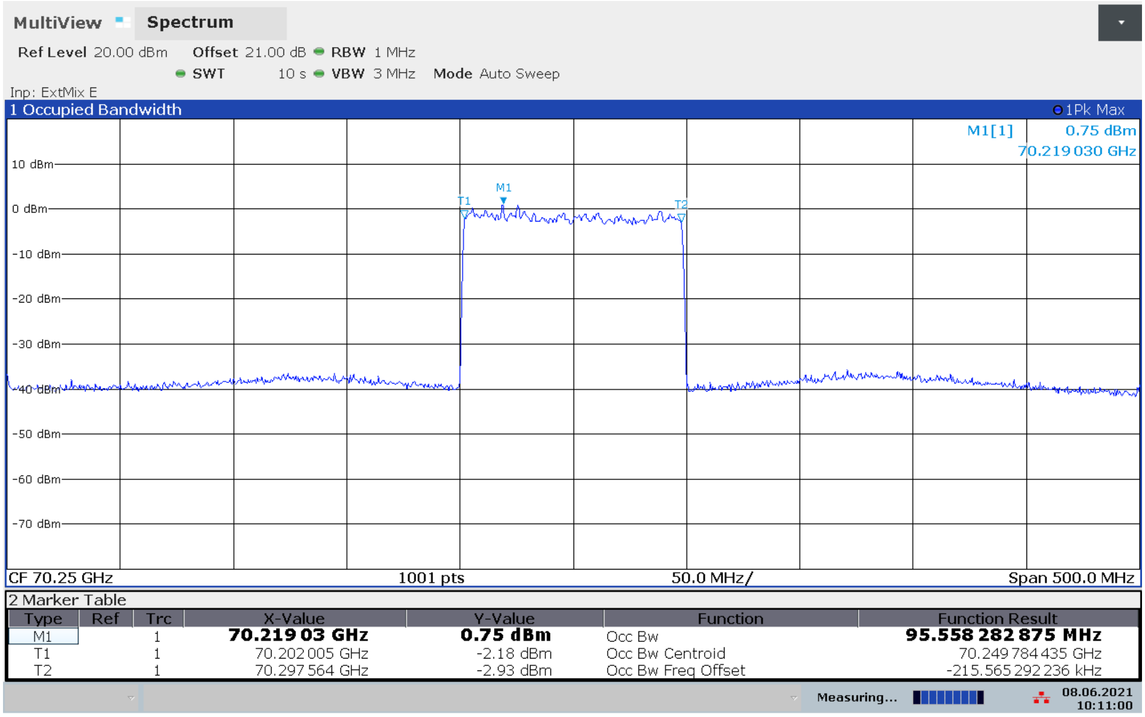
Plot 20: 20 dB OBW



10:26:31 08.06.2021

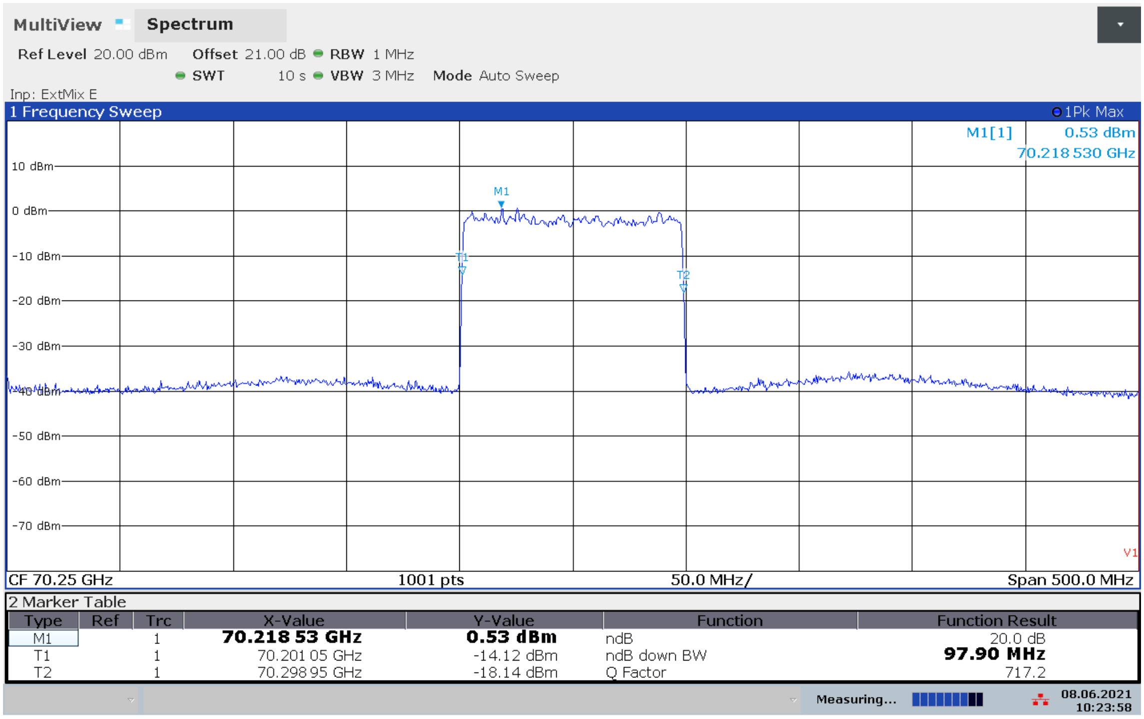
Middle Band – Mid band – 96 MHz

Plot 21: 99% OBW



10:11:00 08.06.2021

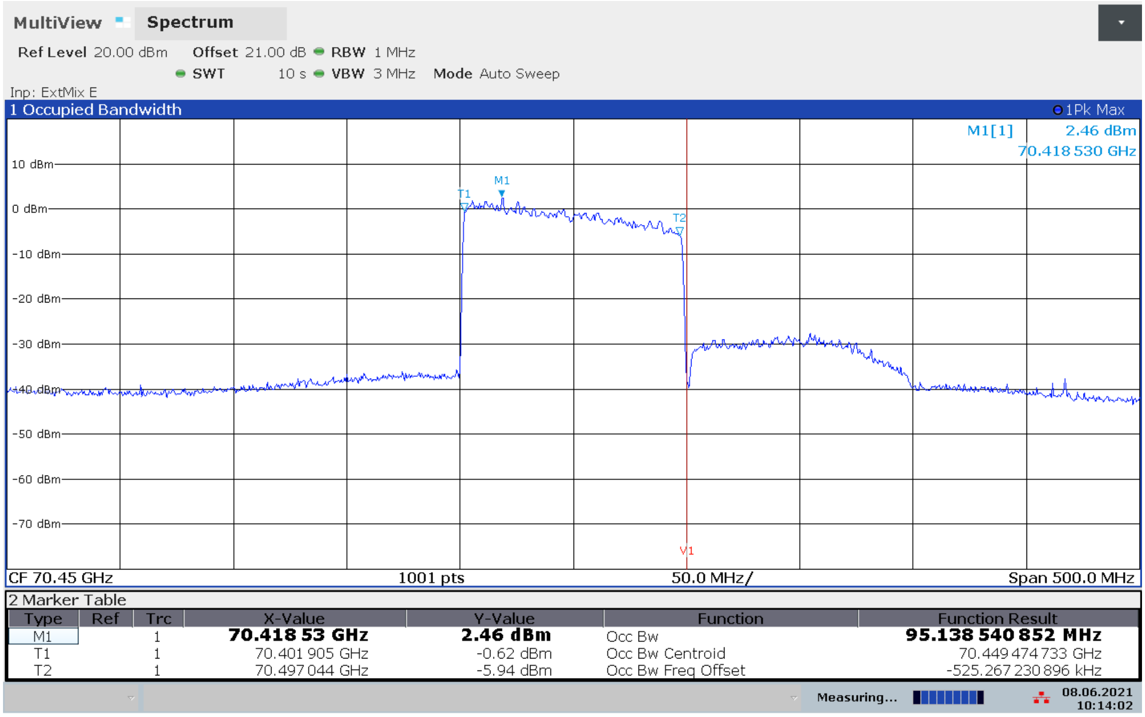
Plot 22: 20 dB OBW



10:23:58 08.06.2021

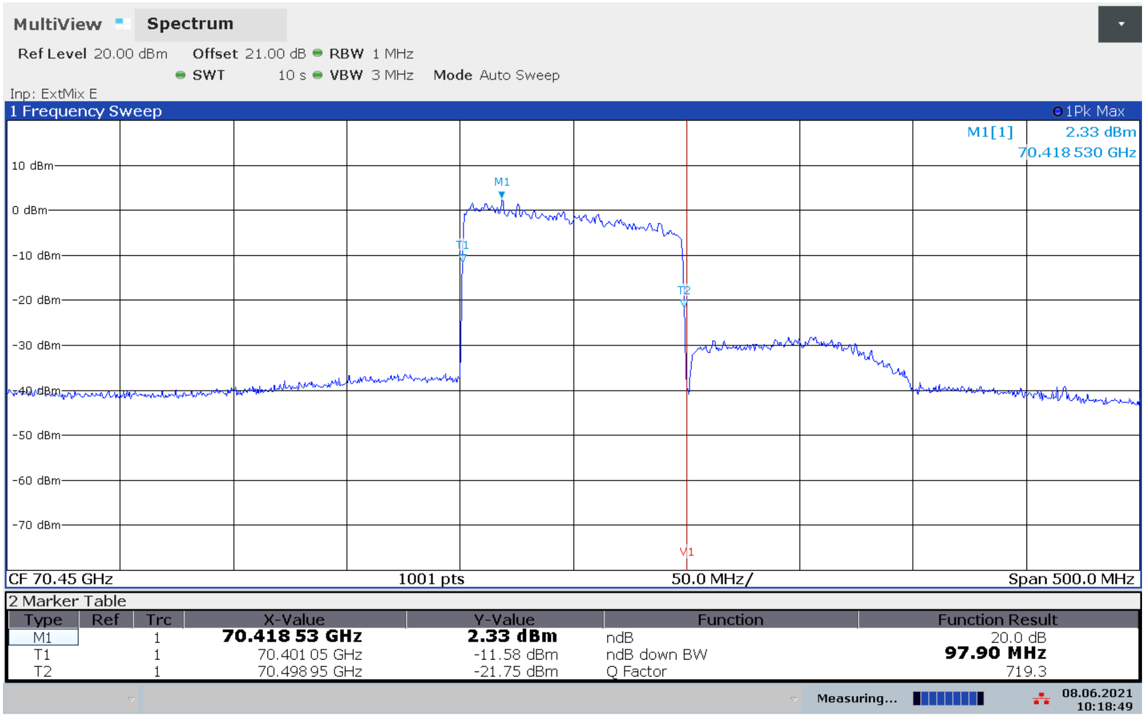
Middle Band – High band edge – 96 MHz

Plot 23: 99% OBW



10:14:02 08.06.2021

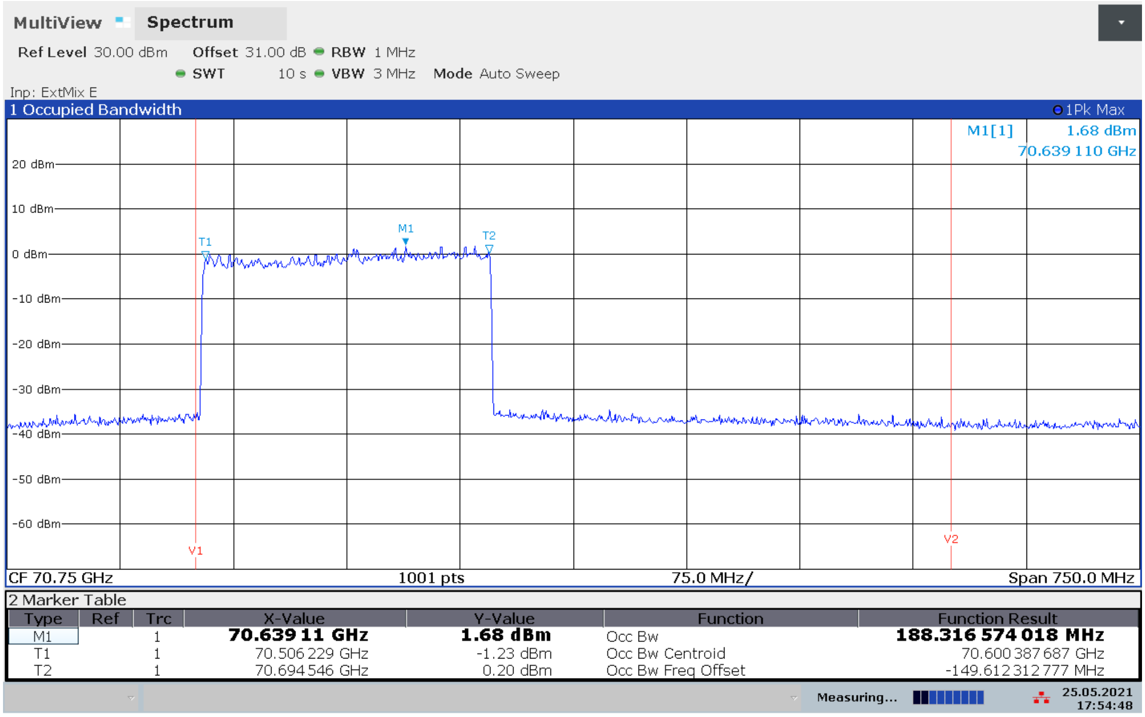
Plot 24: 20 dB OBW



10:18:49 08.06.2021

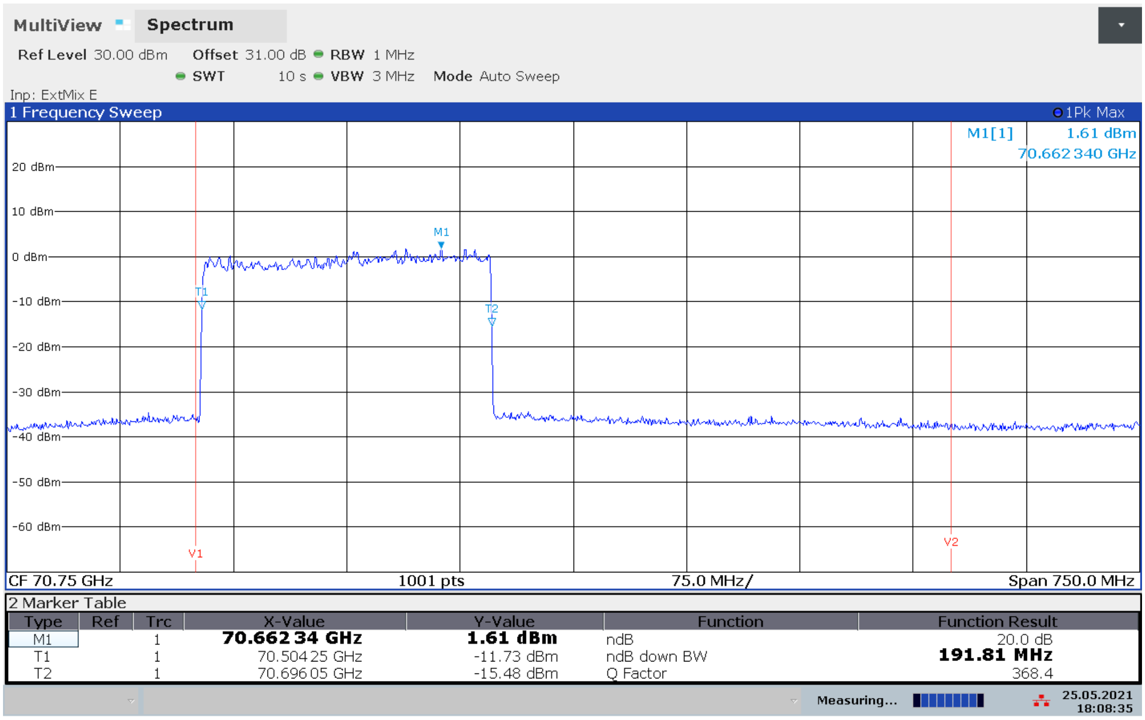
High Band – Low band edge – 192 MHz

Plot 25: 99% OBW



17:54:49 25.05.2021

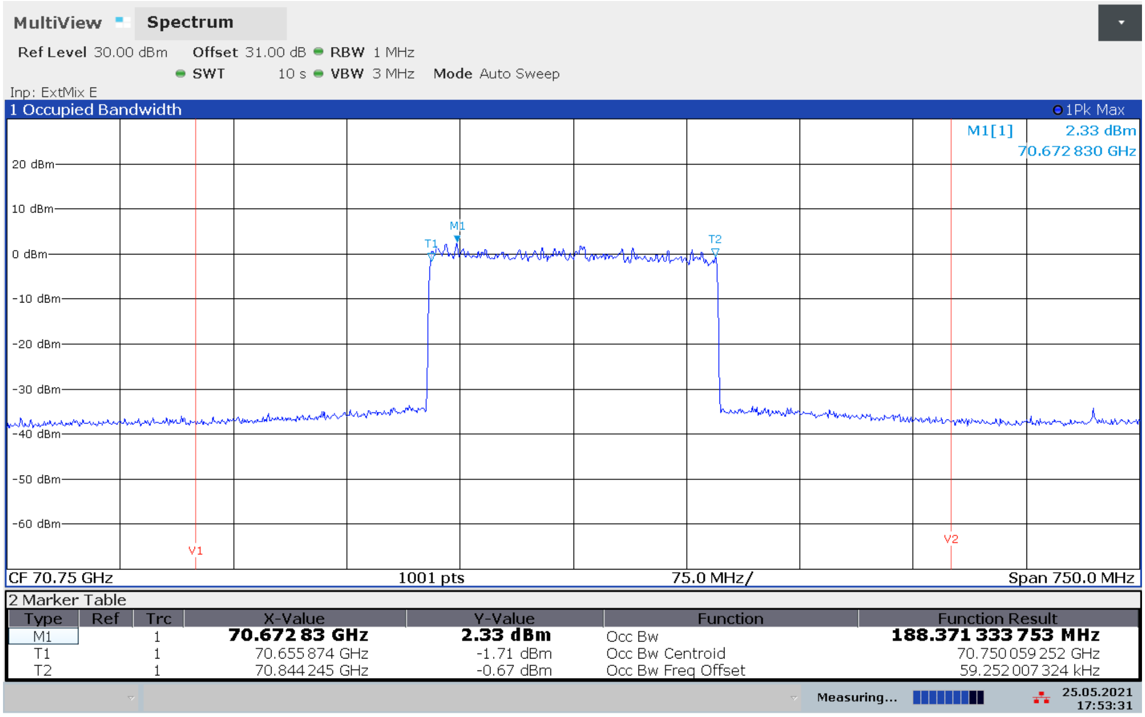
Plot 26: 20 dB OBW



18:08:35 25.05.2021

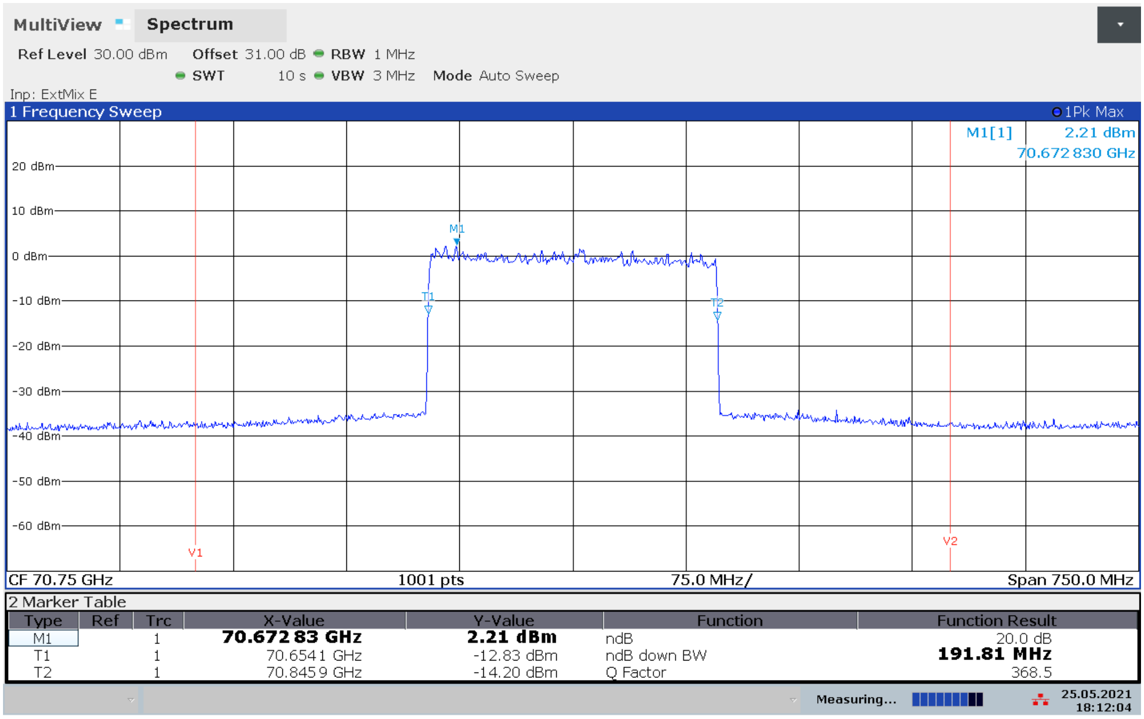
High Band – Mid band – 192 MHz

Plot 27: 99% OBW



17:53:32 25.05.2021

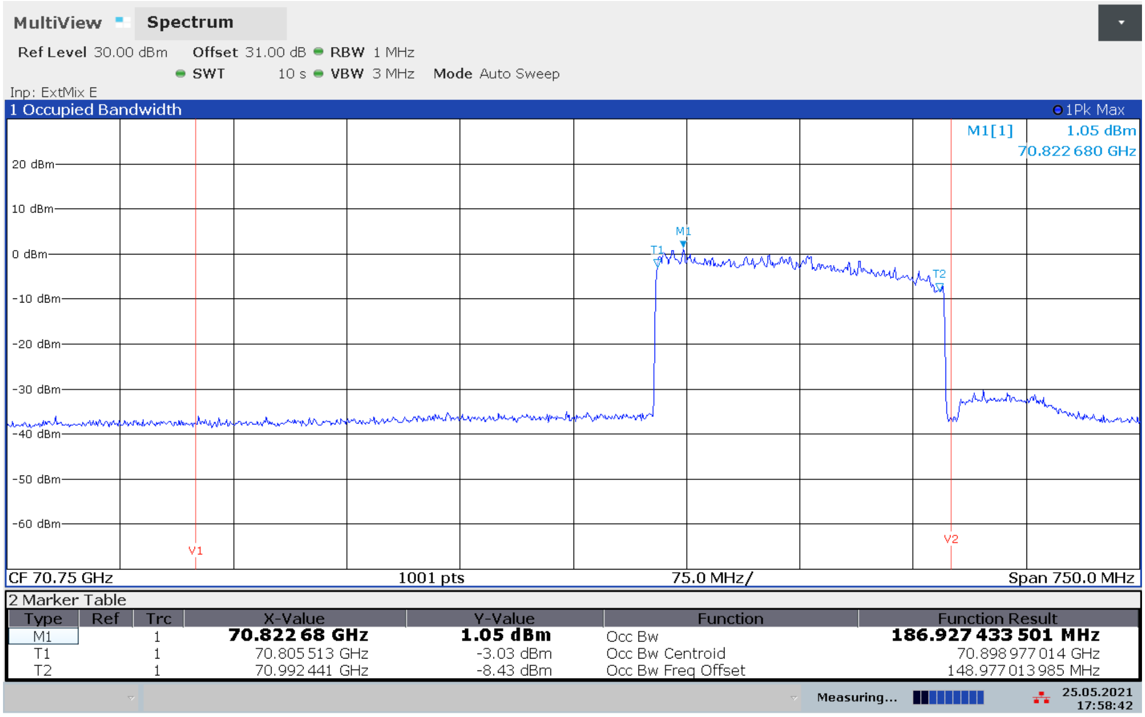
Plot 28: 20 dB OBW



18:12:04 25.05.2021

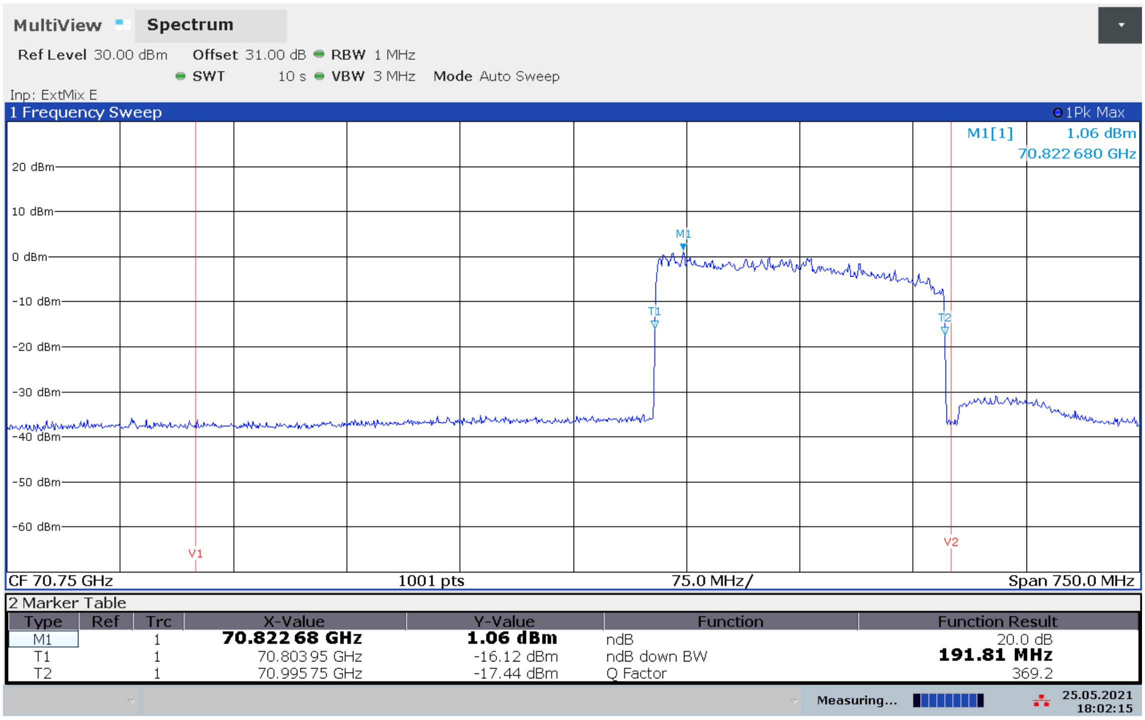
High Band – High band edge – 192 MHz

Plot 29: 99% OBW



17:58:43 25.05.2021

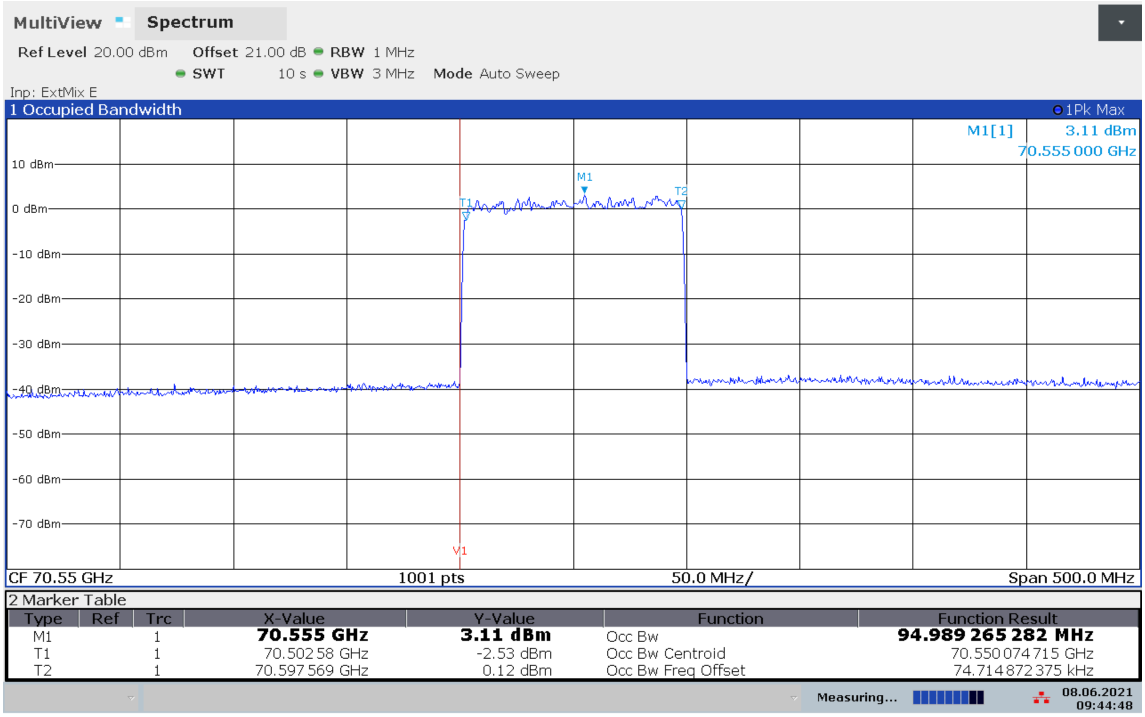
Plot 30: 20 dB OBW



18:02:16 25.05.2021

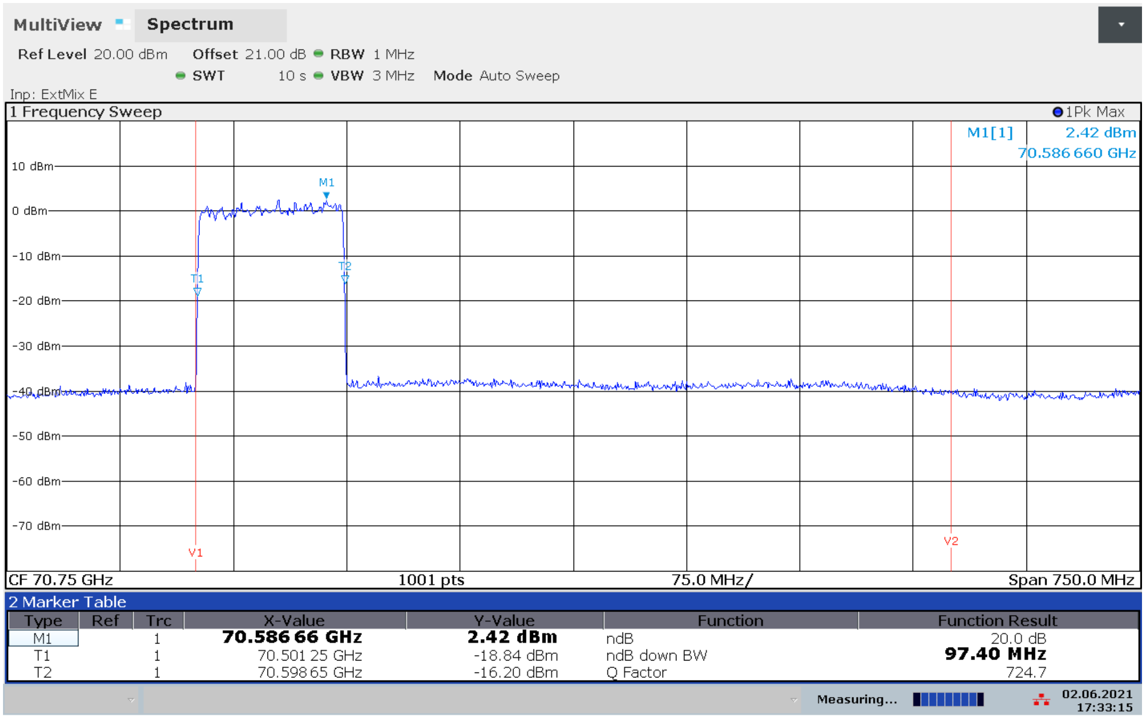
High Band – Low band edge – 96 MHz

Plot 31: 99% OBW



09:44:49 08.06.2021

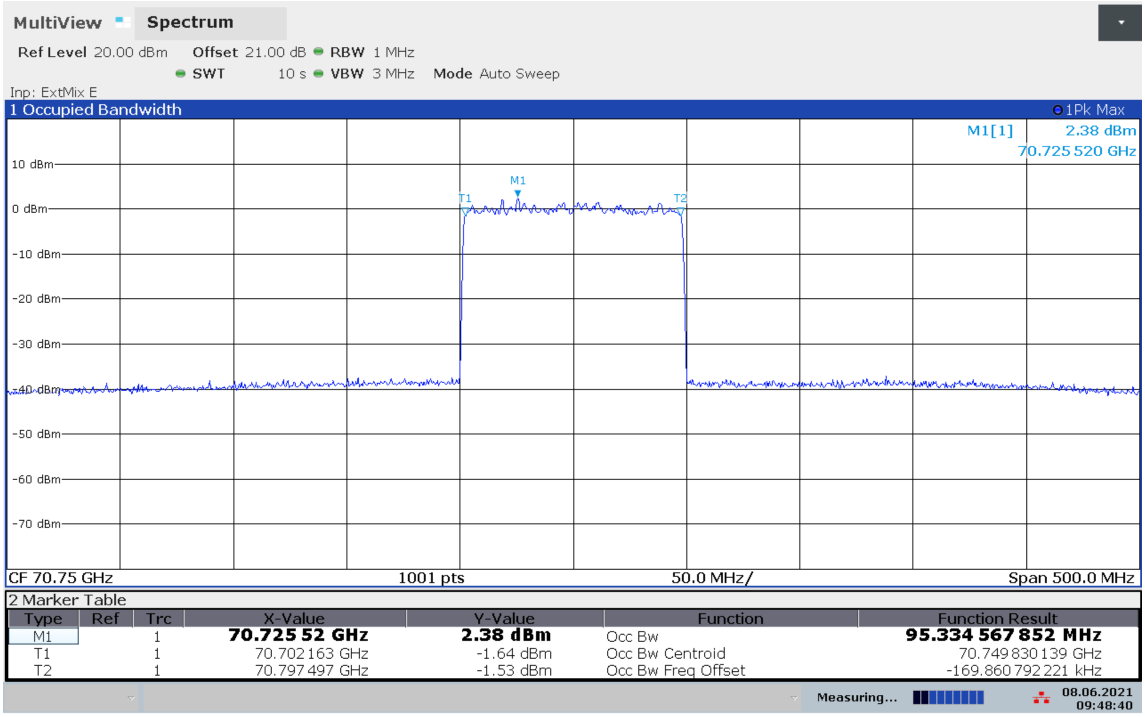
Plot 32: 20 dB OBW



17:33:15 02.06.2021

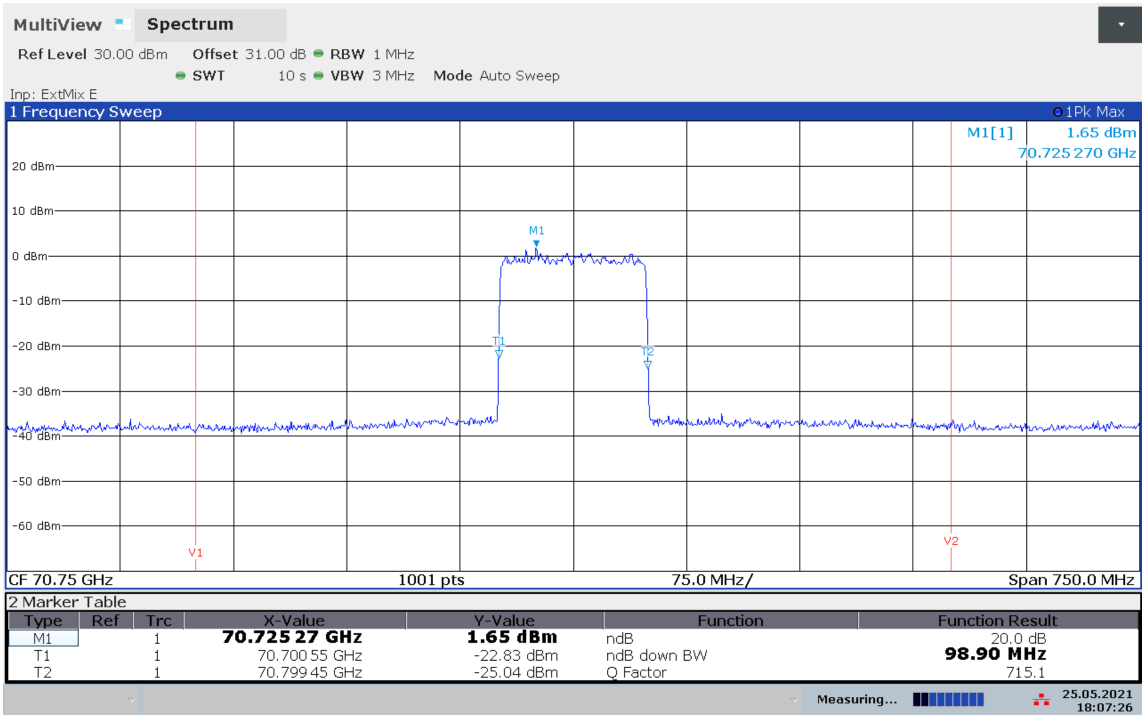
High Band – Mid band – 96 MHz

Plot 33: 99% OBW



09:48:41 08.06.2021

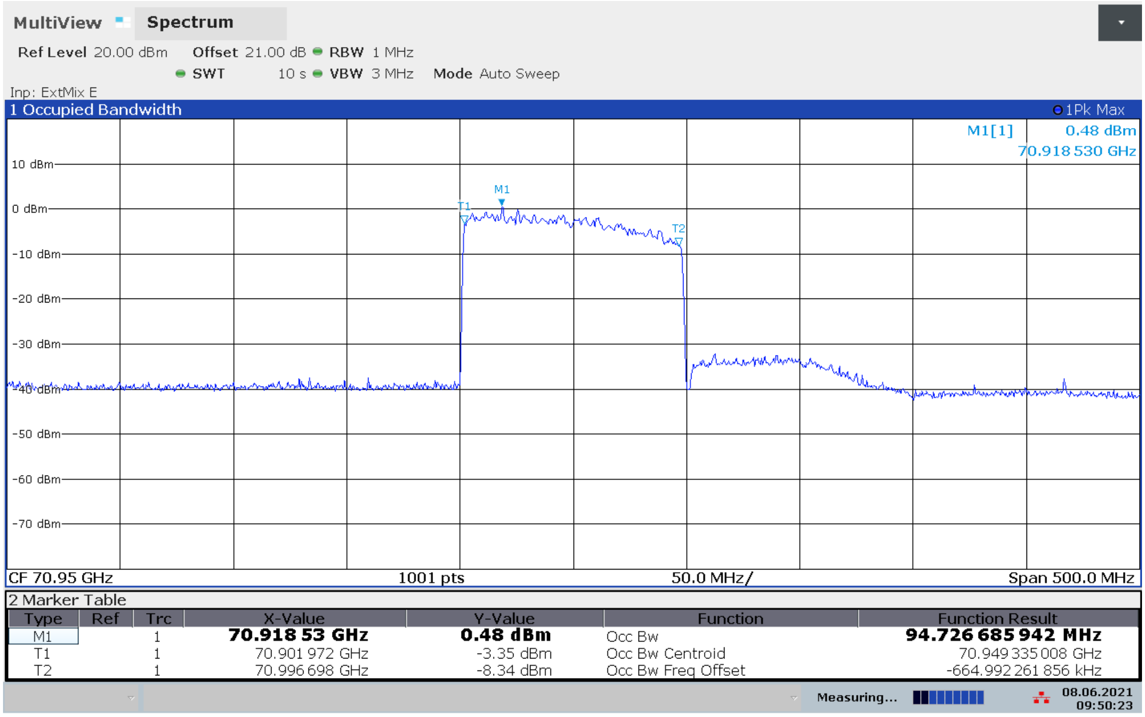
Plot 34: 20 dB OBW



18:07:26 25.05.2021

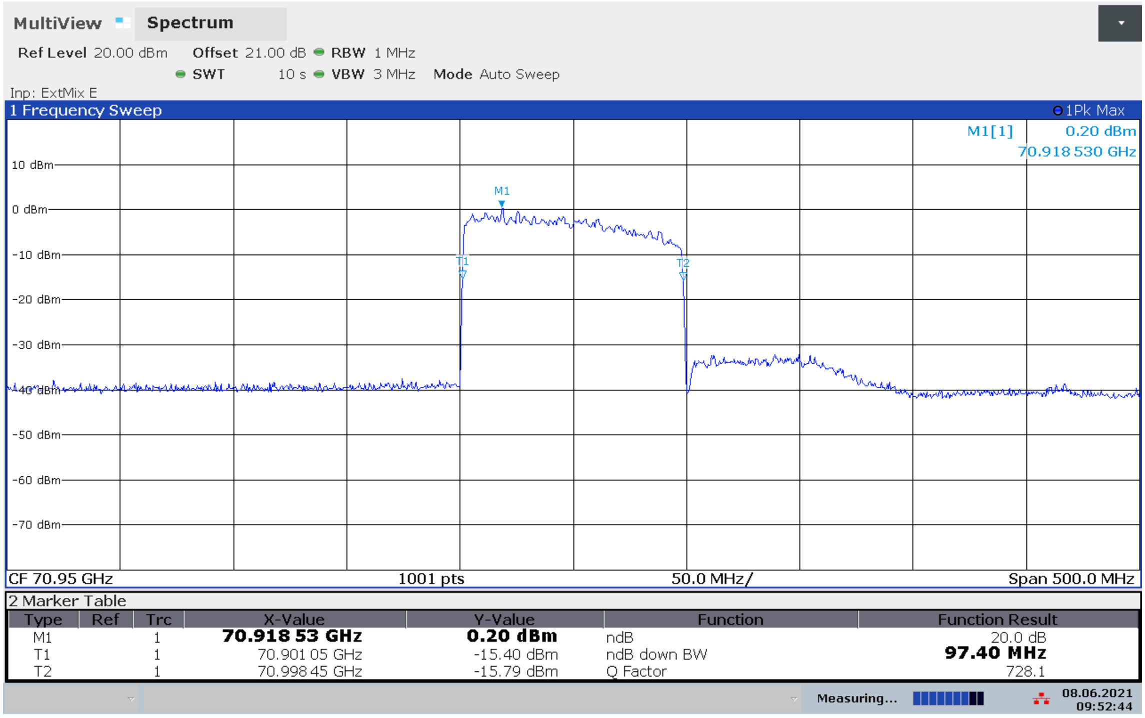
High Band – High band edge – 96 MHz

Plot 35: 99% OBW



09:50:23 08.06.2021

Plot 36: 20 dB OBW



09:52:45 08.06.2021

11.2 Maximum Transmitter Output Power

Description:

Measurement of the maximum conducted output power of the wanted signal.
The CLGD DOCSIS generator was set to 36 dBmV for a 192 MHz OFDM signal and to 33 dBmV for a 96 MHz OFDM signal. At full band use of 500 MHz the input power to the Downlink Tx-units was 4 dBm measured with power meter.

Limits: **FCC Part 15.255 (e) / RSS-210 J.4**

The peak transmitter conducted output power shall not exceed 500 mW = 27 dBm.

The peak power shall be measured with an RF detector that has a detection bandwidth that encompasses the 57-71 GHz band and has a video bandwidth of at least 10 MHz. The average emission levels shall be measured over the actual time period during which transmission occurs.

Measurement:

Measurement parameter	
Detector:	Pos-Peak (RF-Detector)
Video bandwidth:	10 MHz
Trace-Mode:	Max Hold

Measurement results:

Test condition	Peak Conducted Output Power 10 MHz VBW
T_{nom} / V_{nom}	24.0 dBm (69.5 – 70.0 GHz band – fully occupied band) 23.1 dBm (70.0 – 70.5 GHz band – fully occupied band) 23.7 dBm (70.5 – 71.0 GHz band – fully occupied band)
Measurement uncertainty	± 3 dB

Result: The measurement is passed.

Note: This measurement represents the worst case setting with operation at saturation level to show compliance with conducted power limit.
Maximum Output power level during operation needs to be reduced depending on the results of the EIRP power measurement (see section 11.3)

Test results overview

	Low Band										
Component	CLGD	CLGD/ Generator	Detector	Detector	Attenuator for peak	Attenuator for RMS	Power measured at rotary attenuator	Power measured at rotary attenuator	Waveguide attenuation	cond. Power	cond. Power
Unit	dBmV	GHz	mV Peak	mV RMS	dB	dB	dBm peak	dBm RMS	dB	dBm peak	dBm RMS
full Band	36 - 33 - 36	69.75	65.9	7.6	4.3	13.9	2.9	-6.8	21.1	**24**	14.3
192 low	36	69.6	35.5	3.78	6.6	16.2	0.4	-9	21.1	21.5	12.1
192 mid	36	69.75	32.4	3.4	6.9	16.2	0.4	-9.2	21.1	21.5	11.9
192 high	36	69.9	23.3	2.1	8.7	19	-1.2	-11.4	21.1	19.9	9.7
96 low	33	69.55	16.1	1.51	10.2	21	-3	-13.7	21.1	18.1	7.4
96 mid	33	69.75	14.7	1.39	10.6	22	-3.2	-14.5	21.1	17.9	6.6
96 high	33	69.95	10.2	0.91	12	25.5	-3.4	-14.8	21.1	17.7	6.3

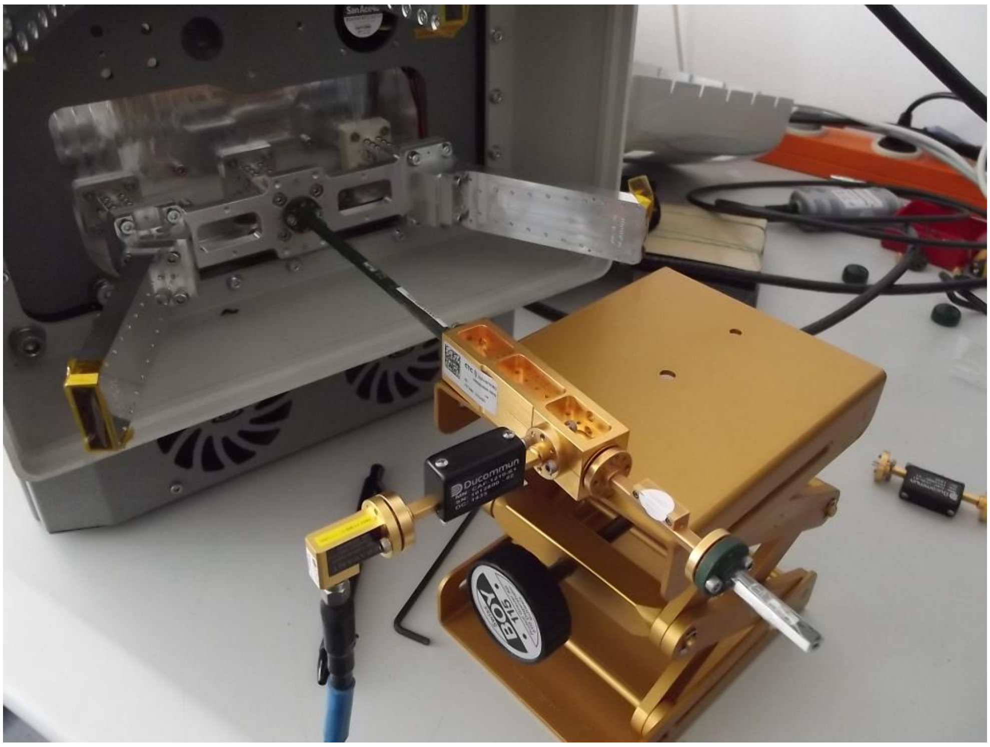
	Mid Band										
Component	CLGD	CLGD/ Generator	Detector	Detector	Attenuator for peak	Attenuator for RMS	Power measured at rotary attenuator	Power measured at rotary attenuator	Waveguide attenuation	cond. Power	cond. Power
Unit	dBmV	GHz	mV Peak	mV RMS	dB	dB	dBm peak	dBm RMS	dB	dBm peak	dBm RMS
full Band	36 - 33 - 36	70.25	44.9	4.48	5.2	14.8	2	-7.5	21.1	**23.1**	13.6
192 low	36	70.1	26.3	2.56	7.9	17.1	-0.7	-9.8	21.2	20.5	11.4
192 mid	36	70.25	16.2	1.66	9.9	19.2	-2.9	-12.2	21.1	18.2	8.9
192 high	36	70.4	19.1	2.2	9.3	18.3	-2.2	-11.1	21.1	18.9	10
96 low	33	70.05	12.4	1.17	11.1	22.1	-4	-15	21.2	17.2	6.2
96 mid	33	70.25	7	0.75	13.1	25.8	-6.1	-18.7	21.1	15	2.4
96 high	33	70.45	9.08	1.01	12.4	21.4	-5.3	-14.2	21.1	15.8	6.9

	High Band										
Component	CLGD	CLGD/ Generator	Detector	Detector	Attenuator for peak	Attenuator for RMS	Power measured at rotary attenuator	Power measured at rotary attenuator	Waveguide attenuation	cond. Power	cond. Power
Unit	dBmV	GHz	mV Peak	mV RMS	dB	dB	dBm peak	dBm RMS	dB	dBm peak	dBm RMS
full Band	36 - 33 - 36	70.75	56.6	2.36	3.85	13.9	3.2	-6.5	20.5	**23.7**	14
192 low	36	70.6	24.2	2.33	7.8	17.8	-1	-10.8	20.45	19.45	9.65
192 mid	36	70.75	24	1.62	7.7	17.5	-0.9	-10.5	20.5	19.6	10
192 high	36	70.9	16.4	1.62	9.2	19.9	-2.4	-12.9	20.3	17.9	7.4
96 low	33	70.55	11.4	1.46	11	20.8	-4.1	-13.8	20.45	16.35	6.65
96 mid	33	70.75	12.3	1.61	10.6	20.8	-3.7	-13.8	20.5	16.8	6.7
96 high	33	70.95	7	0.88	10.8	22.2	-5.9	-15.3	20.3	14.4	5

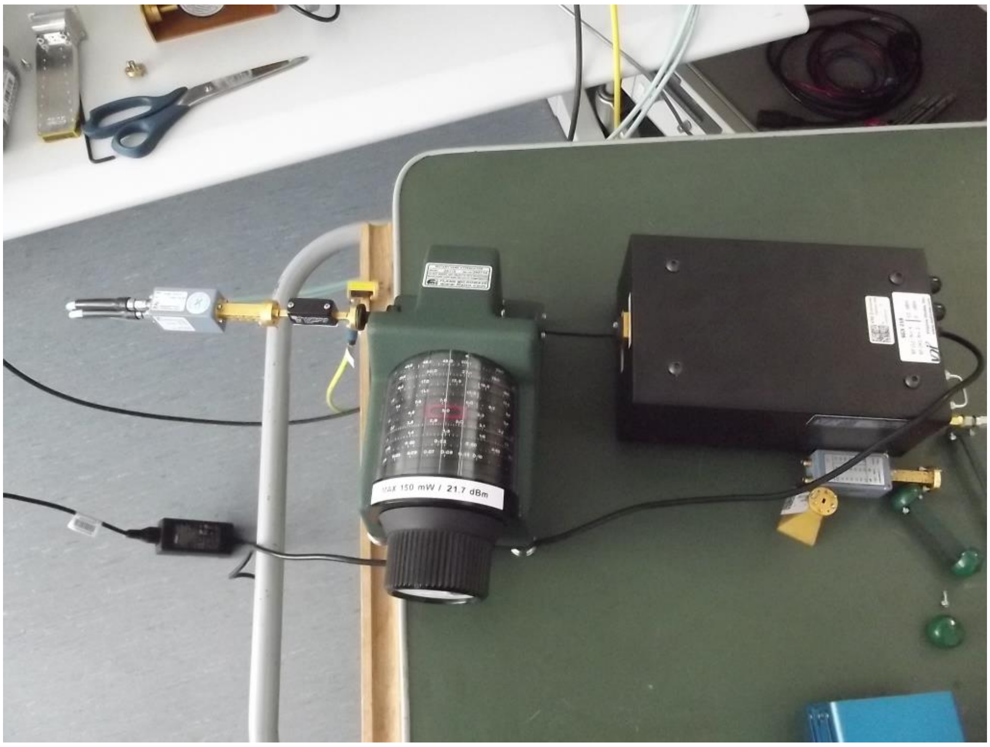
Note: full band use consists of a 192 MHz block at low band edge, a 96 MHz block at mid band and a 192 MHz block at higher band edge

11.2.1 Set-up and Calculation of the conducted output power:

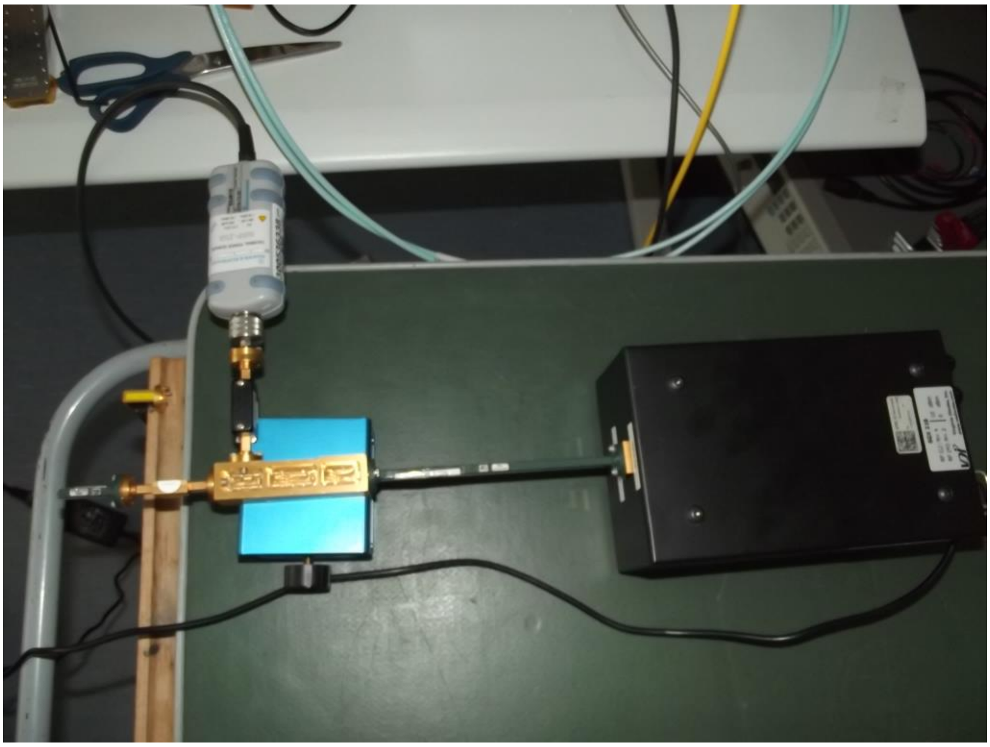
Measurement of RF output power with RF Detector at waveguide coupler output.



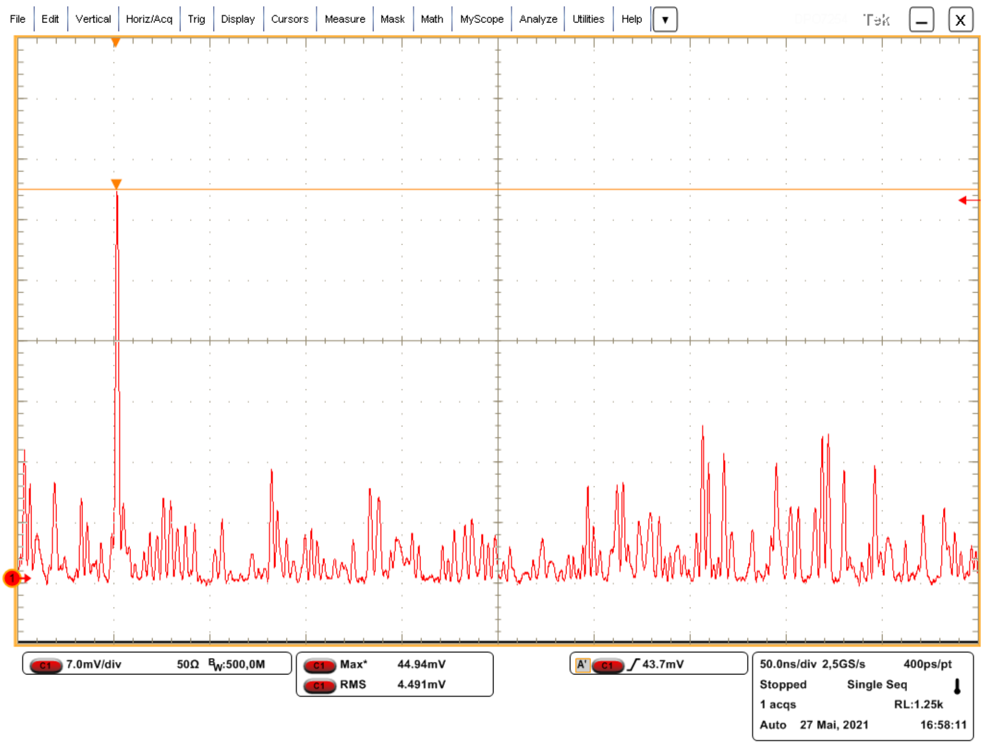
Reference measurement with RF multiplier and rotary attenuator, shown here with RF detector and mixer.



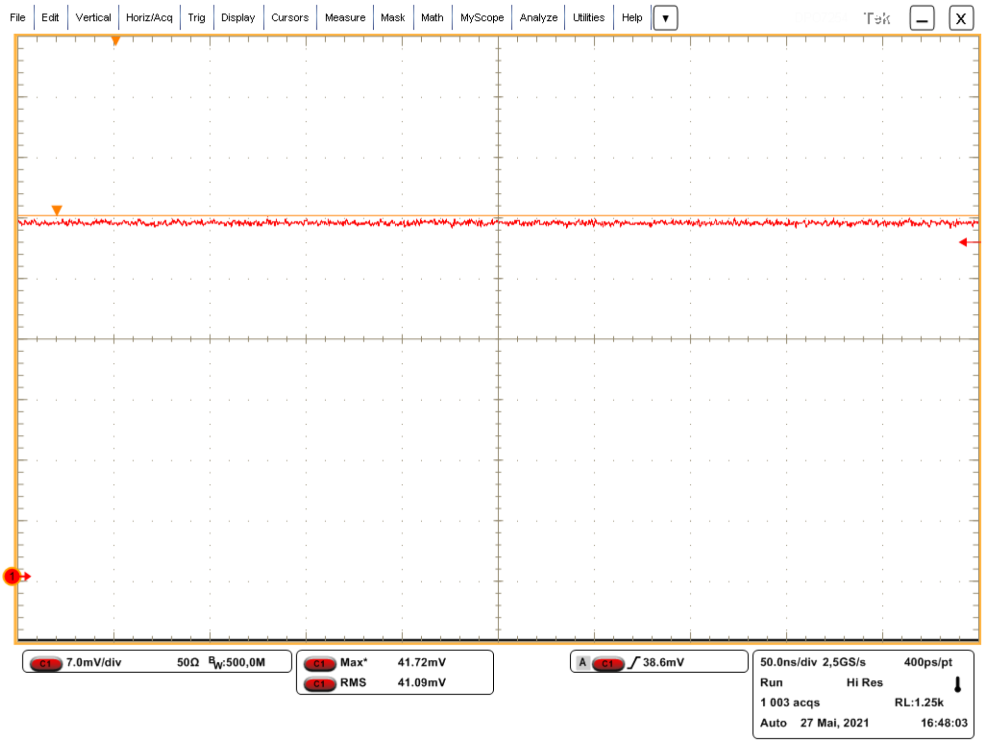
Measuring of waveguide attenuation (directional coupler and 10 dB attenuator)



Example picture of oscilloscope



Reference level of multiplier



11.3 Maximum E.I.R.P.

Description:

Measurement of the maximum radiated e.i.r.p. of the wanted signal.
The CLGD DOCSIS generator was set to 30 dBmV for a 192 MHz OFDM signal and to 27 dBmV for a 96 MHz OFDM signal. At full band use of 500 MHz the input power to the Downlink Tx-units was **-2 dBm** measured with power meter.

Limits: **FCC Part 15.255**

(c) Within the 57-71 GHz band, emission levels shall not exceed the following equivalent isotropically radiated power (EIRP):

(1) Products other than fixed field disturbance sensors and short-range devices for interactive motion sensing shall comply with one of the following emission limits, as measured during the transmit interval:

(i) The average power of any emission shall not exceed 40 dBm and the peak power of any emission shall not exceed 43 dBm; or

(ii) For fixed point-to-point transmitters located outdoors, the average power of any emission shall not exceed 82 dBm, and shall be reduced by 2 dB for every dB that the antenna gain is less than 51 dBi. The peak power of any emission shall not exceed 85 dBm, and shall be reduced by 2 dB for every dB that the antenna gain is less than 51 dBi.

(A) The provisions in this paragraph for reducing transmit power based on antenna gain shall not require that the power levels be reduced below the limits specified in paragraph (b)(1)(i) of this section.

(B) The provisions of §15.204(c)(2) and (4) that permit the use of different antennas of the same type and of equal or less directional gain do not apply to intentional radiator systems operating under this provision. In lieu thereof, intentional radiator systems shall be certified using the specific antenna(s) with which the system will be marketed and operated. Compliance testing shall be performed using the highest gain and the lowest gain antennas for which certification is sought and with the intentional radiator operated at its maximum available output power level. The responsible party, as defined in §2.909 of this chapter, shall supply a list of acceptable antennas with the application for certification.

(2) For fixed field disturbance sensors that occupy 500 MHz or less of bandwidth and that are contained wholly within the frequency band 61.0-61.5 GHz, the average power of any emission, measured during the transmit interval, shall not exceed 40 dBm, and the peak power of any emission shall not exceed 43 dBm. In addition, the average power of any emission outside of the 61.0-61.5 GHz band, measured during the transmit interval, but still within the 57-71 GHz band, shall not exceed 10 dBm, and the peak power of any emission shall not exceed 13 dBm.

(3) For fixed field disturbance sensors other than those operating under the provisions of paragraph (b)(2) of this section, and short-range devices for interactive motion sensing, the peak transmitter conducted output power shall not exceed −10 dBm and the peak EIRP level shall not exceed 10 dBm.

(4) The peak power shall be measured with an RF detector that has a detection bandwidth that encompasses the 57-71 GHz band and has a video bandwidth of at least 10 MHz. The average emission levels shall be measured over the actual time period during which transmission occurs.

(e) Except as specified paragraph (e)(1) of this section, the peak transmitter conducted output power shall not exceed 500 mW. Depending on the gain of the antenna, it may be necessary to operate the intentional radiator using a lower peak transmitter output power in order to comply with the EIRP limits specified in paragraph (b) of this section.

(1) Transmitters with an emission bandwidth of less than 100 MHz must limit their peak transmitter conducted output power to the product of 500 mW times their emission bandwidth divided by 100 MHz. For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (e.g., for frequency hopping devices).
(2) Peak transmitter conducted output power shall be measured with an RF detector that has a detection bandwidth that encompasses the 57-71 GHz band and that has a video bandwidth of at least 10 MHz.
(3) For purposes of demonstrating compliance with this paragraph, corrections to the transmitter conducted output power may be made due to the antenna and circuit loss.

Limits: **RSS-210 J.2.2 b.**

Within the band 57-64 GHz, the power of any emissions, measured during in the transmit interval, shall comply with the e.i.r.p. limits in this section.

For the purpose of this standard, the terms" average e.i.r.p." and "peak e.i.r.p." refer to e.i.r.p. with transmitter output power measured in terms of average value or peak value respectively.

Measurement:

Measurement parameter	
Detector:	Pos-Peak (RF-Detector)
Video bandwidth:	10 MHz
Trace-Mode:	Max Hold

Measurement results:

Test condition	Frequency Band	Peak E.I.R.P. 10 MHz VBW	Peak E.I.R.P Limit	Average E.I.R.P. 10 MHz VBW	Average E.I.R.P. Limit
T_{nom} / V_{nom}	69.5 – 70.0 GHz	42.4 dBm	43 dBm	30.7 dBm	40 dBm
T_{nom} / V_{nom}	70.0 – 70.5 GHz	42.2 dBm	43 dBm	30.4 dBm	40 dBm
T_{nom} / V_{nom}	70.5 – 71 GHz	41.9 dBm	43 dBm	29.8 dBm	40 dBm
Measurement uncertainty		± 3 dB			

Result: The measurement is passed, when the input signal to the single transmitter units does not exceed – 2 dBm at full band use of 500 MHz!

	Low Band										
Component	CLGD	CLGD/ Generator	Detector	Detector	Max EIRP of reference source	Attenuator for peak	Attenuator for RMS	measured EIRP	measured EIRP		
Unit	dBmV	GHz	mV Peak	mV RMS	dBm	dB	dB	dBm peak	dBm RMS		
full Band	30 – 27 - 30	69.75	207.6	54.8	45.4	3.0	14.7	**42.4**	**30.7**		

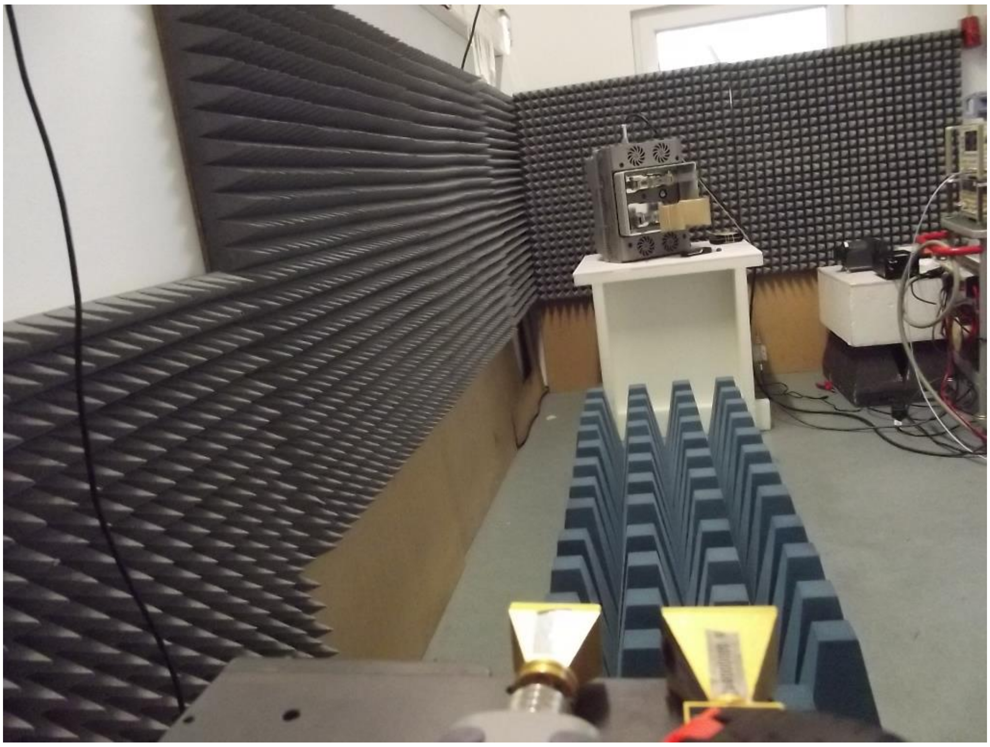
	Mid Band										
Component	CLGD	CLGD/ Generator	Detector	Detector	Max EIRP of reference source	Attenuator for peak	Attenuator for RMS	measured EIRP	measured EIRP		
Unit	dBmV	GHz	mV Peak	mV RMS	dBm	dB	dB	dBm peak	dBm RMS		
full Band	30 – 27 - 30	70.25	162	44.7	45.5	3.3	15.1	**42.2**	**30.4**		

	High Band										
Component	CLGD	CLGD/ Generator	Detector	Detector	Max EIRP of reference source	Attenuator for peak	Attenuator for RMS	measured EIRP	measured EIRP		
Unit	dBmV	GHz	mV Peak	mV RMS	dBm	dB	dB	dBm peak	dBm RMS		
full Band	30 – 27 - 30	70.75	169.2	47.8	45.6	3.5	15.6	**41.9**	**29.8**		

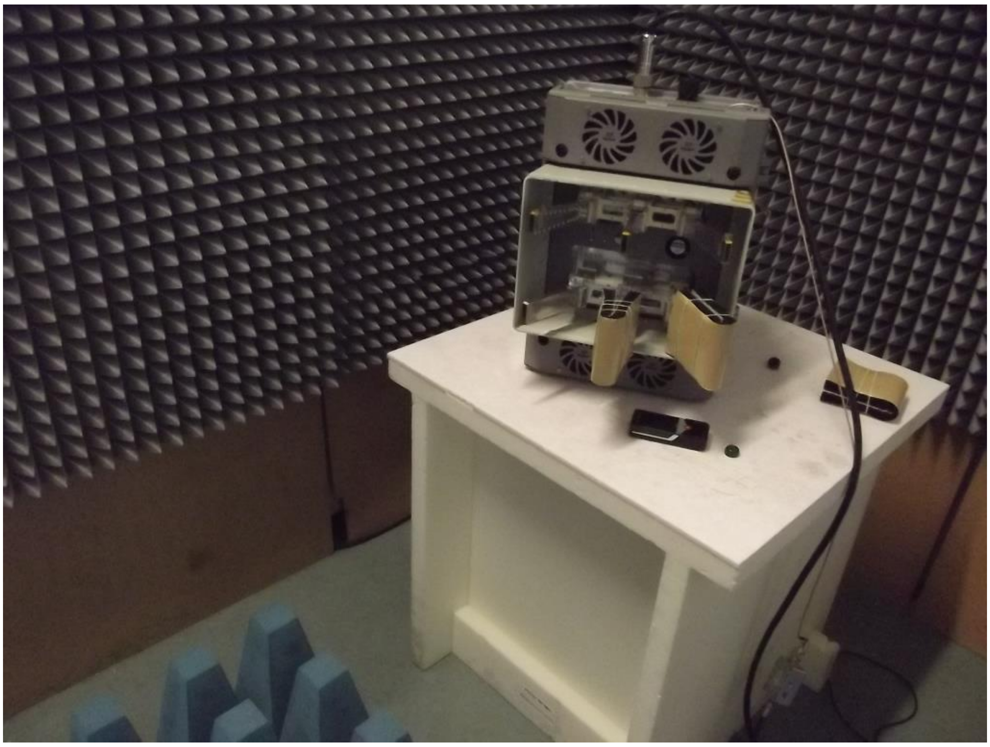
Note:
full band use consists of a 192 MHz block at low band edge, a 96 MHz block at mid band and a 192 MHz block at higher band edge.

11.3.1 Set-up of radiated RF-detector- and power measurement:

EUT position:



EUT during high band measurement



Replacement of EUT by reference source:

Attenuation of rotary attenuator to align peak level of EUT at oscilloscope:

Example plot of oscilloscope with peak value at 69.5 – 70.0 GHz band

Example plot of reference voltage from multiplier

11.4 Spurious emissions radiated

Description:

Measurement of the radiated spurious emissions in transmit mode.

Limits: **FCC Part 15.255 / RSS-210 J.3**

(c) Limits on spurious emissions:

(1) The power density of any emissions outside the 57-71 GHz band shall consist solely of spurious emissions.

(2) Radiated emissions below 40 GHz shall not exceed the general limits in §15.209.

FCC / IC		
CFR Part 15.209(a) / RSS-210 / RSS-Gen		
Radiated Spurious Emissions		
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

(3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm^2 (-10dBm) at a distance of 3 meters.

(4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

Limit conversion:

$P[dBm] = 10 \times \log(4 \times \pi \times d^2 \times P[W/m^2])$

d = distance of the limit defined in W/m^2

With this calculation an emission limit of 90 pW/cm^2 corresponds to -10 dBm.

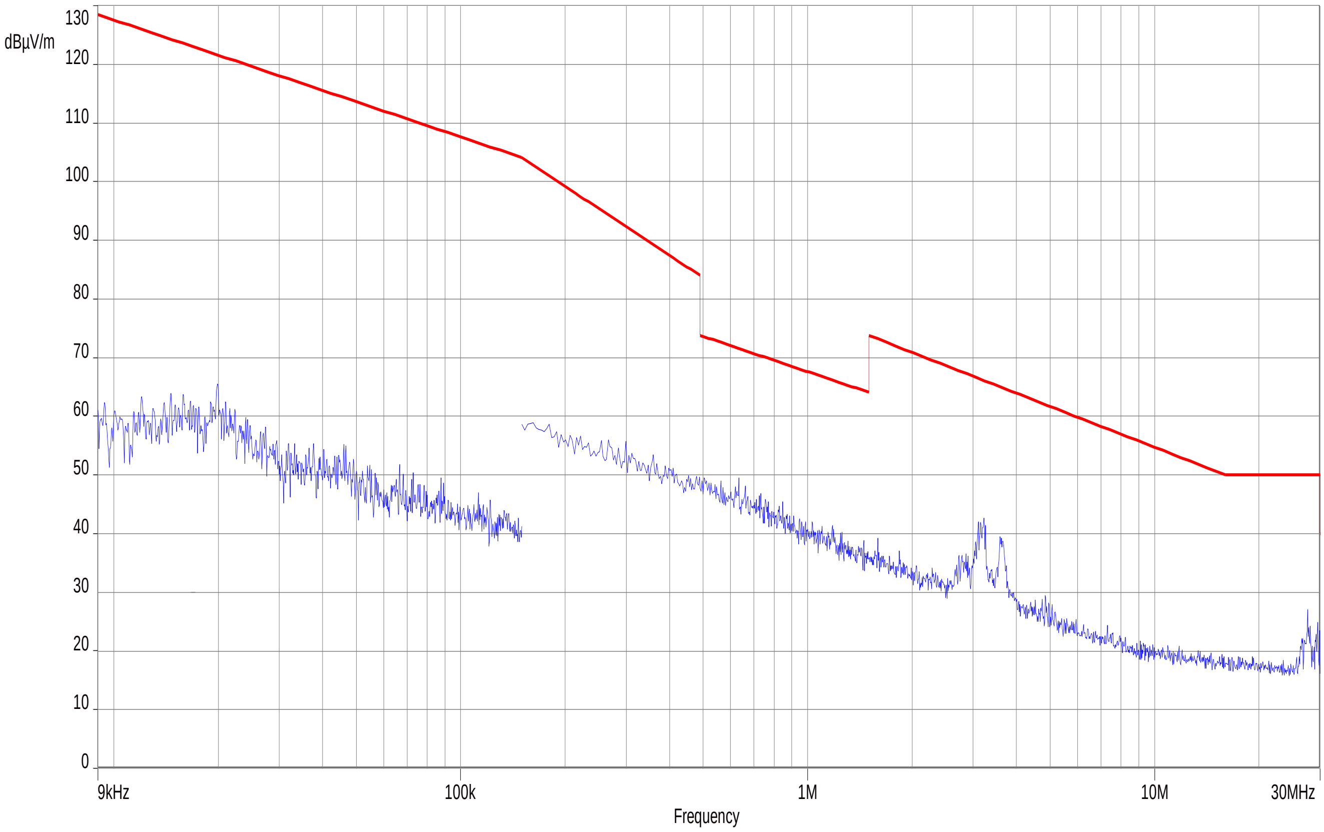
Measurement:

Measurement parameter	
Detector:	Quasi Peak / Pos-Peak / RMS
Sweep time:	Auto
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Video bandwidth:	Auto
Frequency range:	30 MHz to 220 GHz
Trace-Mode:	Max Hold

Result: The measurement is passed for class A limit

Note:
Spurious emissions worst case measurement was tested with all three transmitters active with 500 MHz OFDM each.

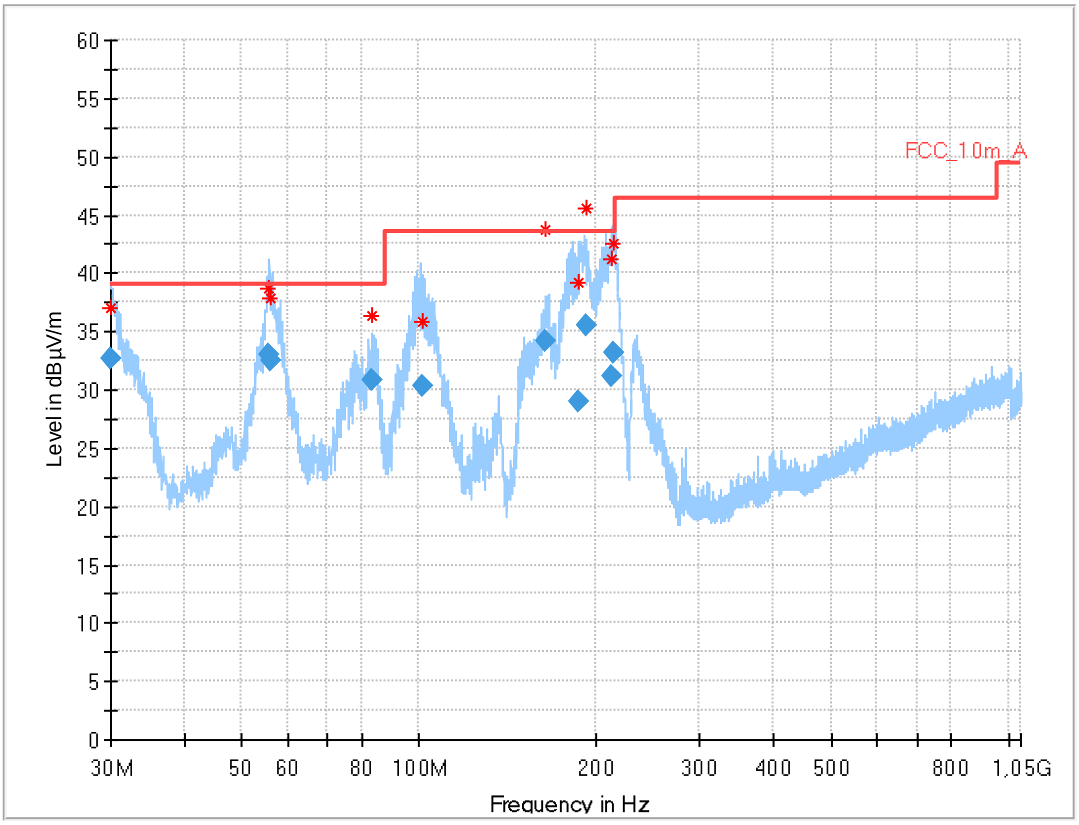
Plot 37: 9 kHz – 30 MHz, horizontal / vertical polarization



Plot 38: 30 MHz – 1 GHz, horizontal / vertical polarization

Common Information

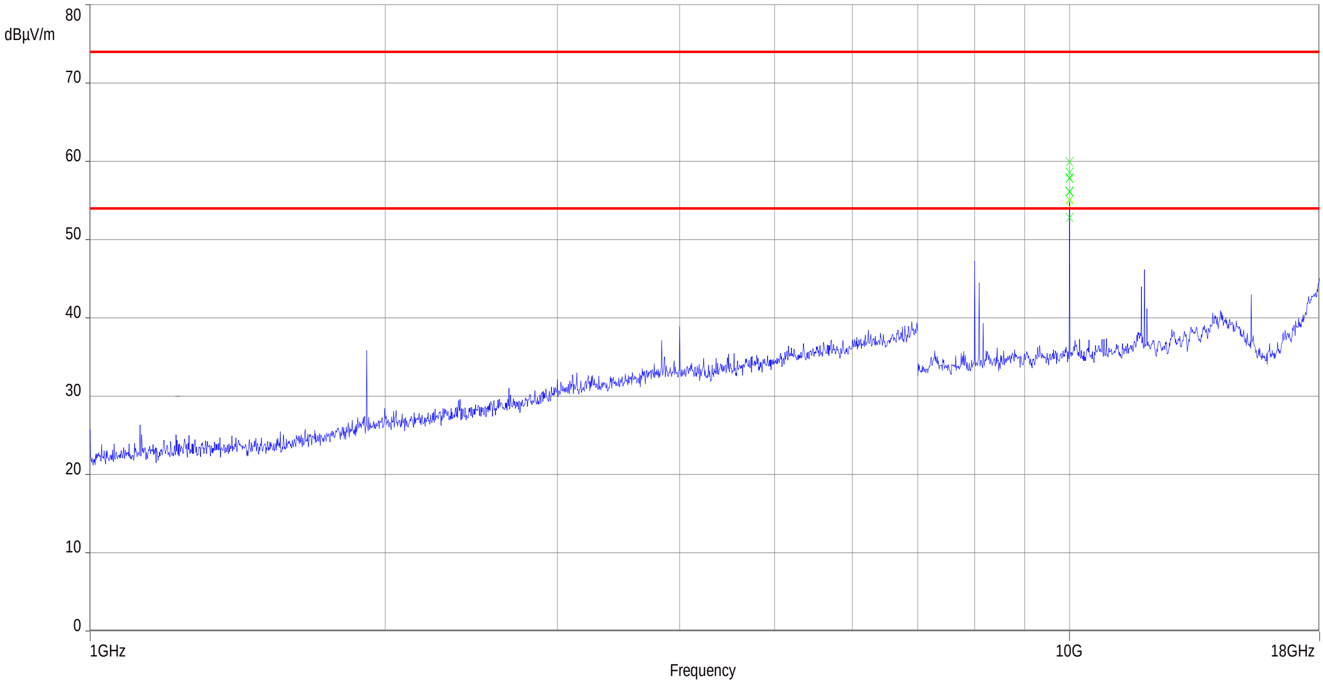
EUT: AIR GIGARAY
Serial number:
Test description: FCC part 15 **class A** @ 10 m
Operating condition: active / radio on
Operator name: MDW
Comment: DC 48 V



Final_Result

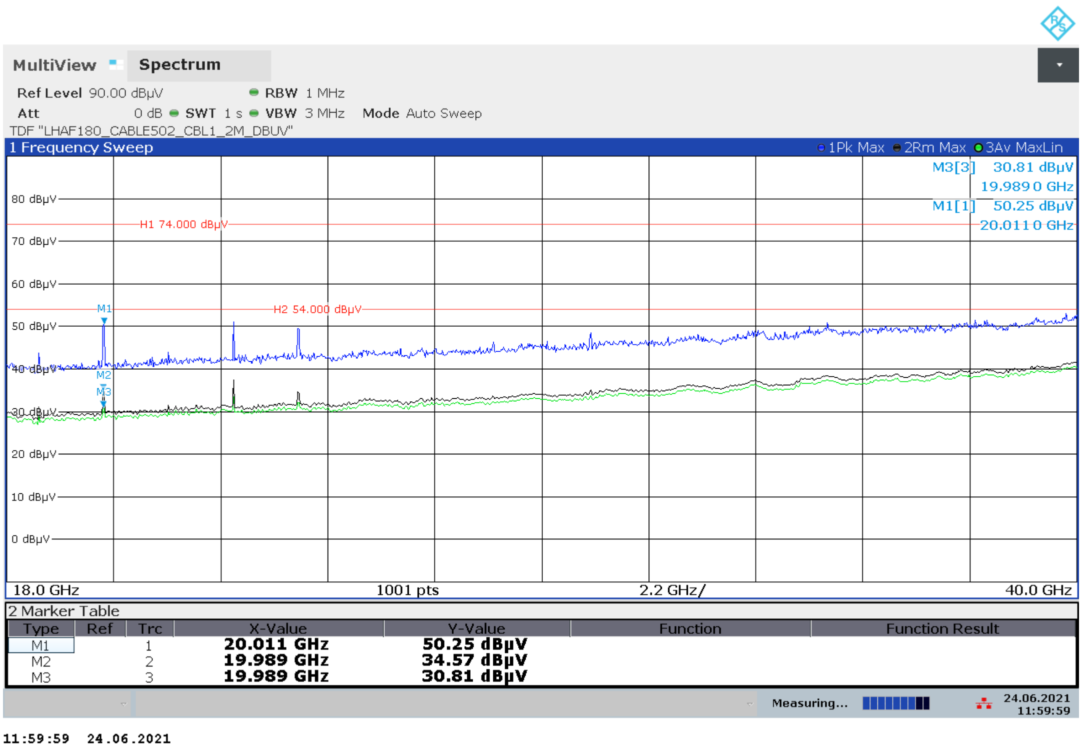
Frequency (MHz)	QuasiPeak (dBµV/m	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.094	32.76	39.1	6.3	1000	120.0	100.0	V	1	12
55.749	32.95	39.1	6.2	1000	120.0	200.0	V	69	15
56.133	32.58	39.1	6.5	1000	120.0	158.0	V	45	15
83.016	30.77	39.1	8.3	1000	120.0	396.0	V	19	8
101.336	30.29	43.5	13.2	1000	120.0	103.0	V	283	13
164.390	34.27	43.5	9.2	1000	120.0	104.0	V	-12	10
186.776	28.98	43.5	14.5	1000	120.0	104.0	V	271	11
191.765	35.55	43.5	8.0	1000	120.0	100.0	V	271	11
212.882	31.10	43.5	12.4	1000	120.0	120.0	V	39	12
214.345	33.24	43.5	10.3	1000	120.0	124.0	V	45	12

Plot 39: 1 GHz – 18 GHz, horizontal / vertical polarization

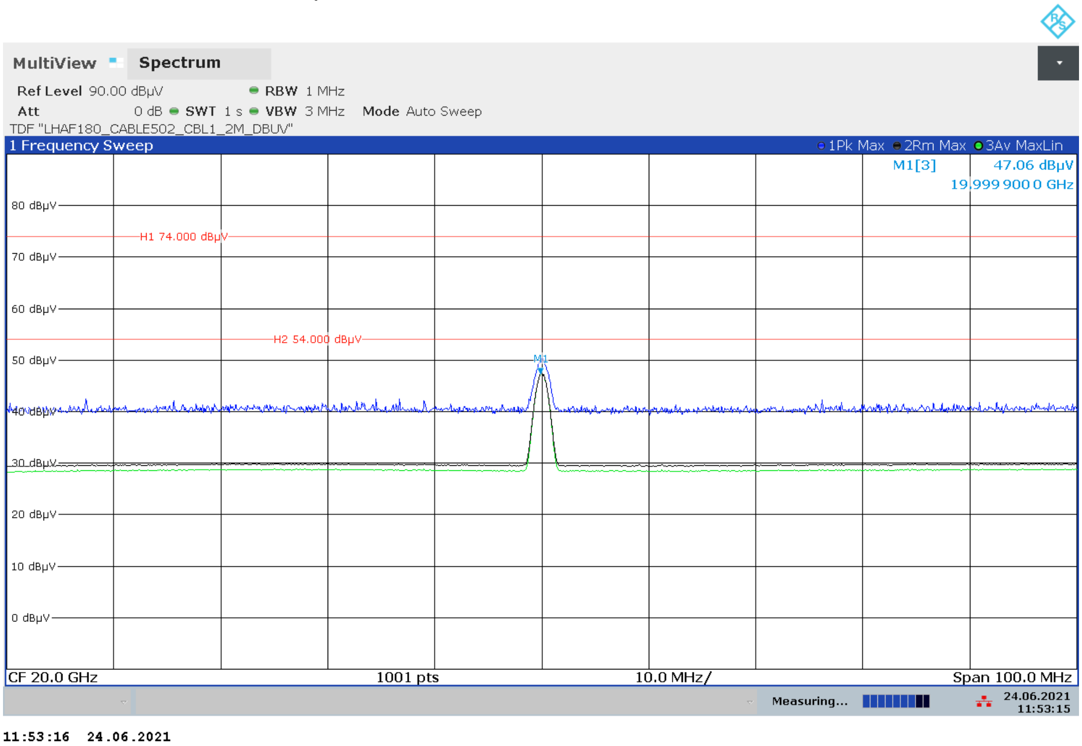


Note: worst case spurious RMS 50.99 dBµV/m @10 GHz

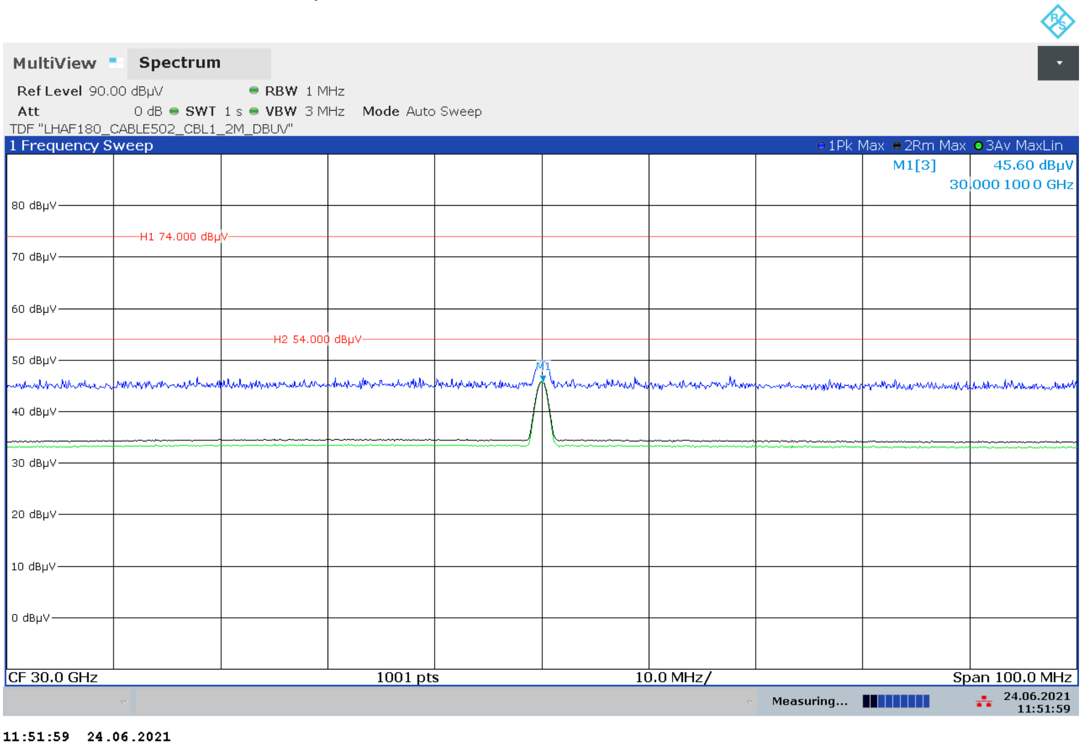
Plot 40: 18 GHz – 40 GHz, horizontal / vertical polarization



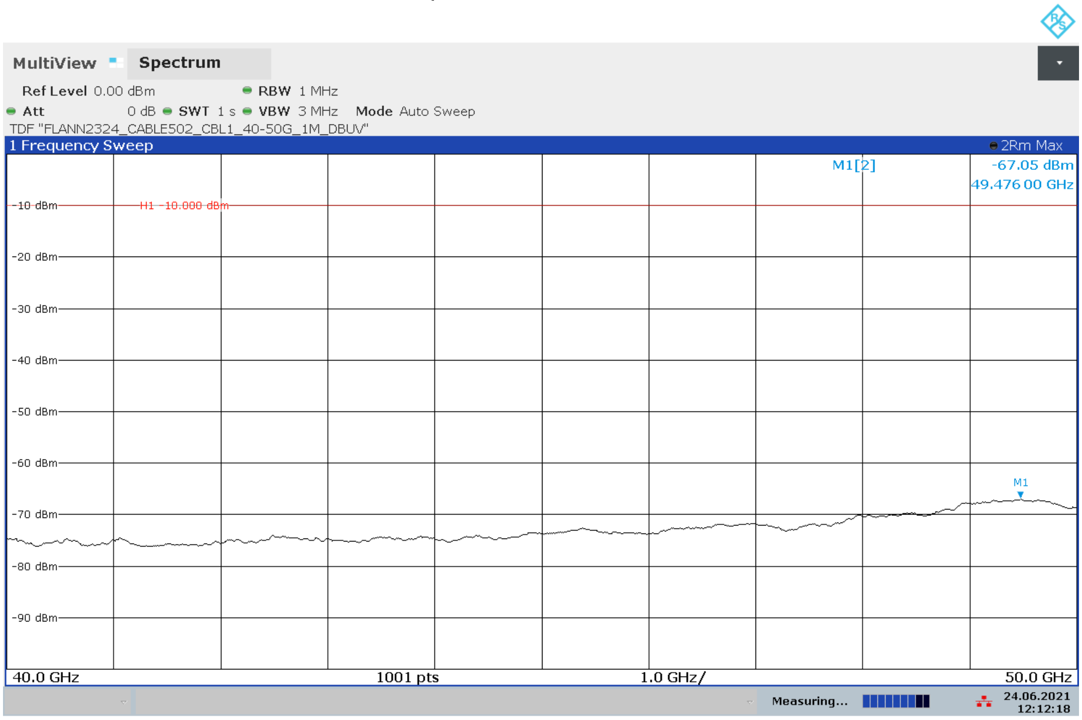
Plot 41: 20 GHz, horizontal / vertical polarization



Plot 42: 30 GHz, horizontal / vertical polarization

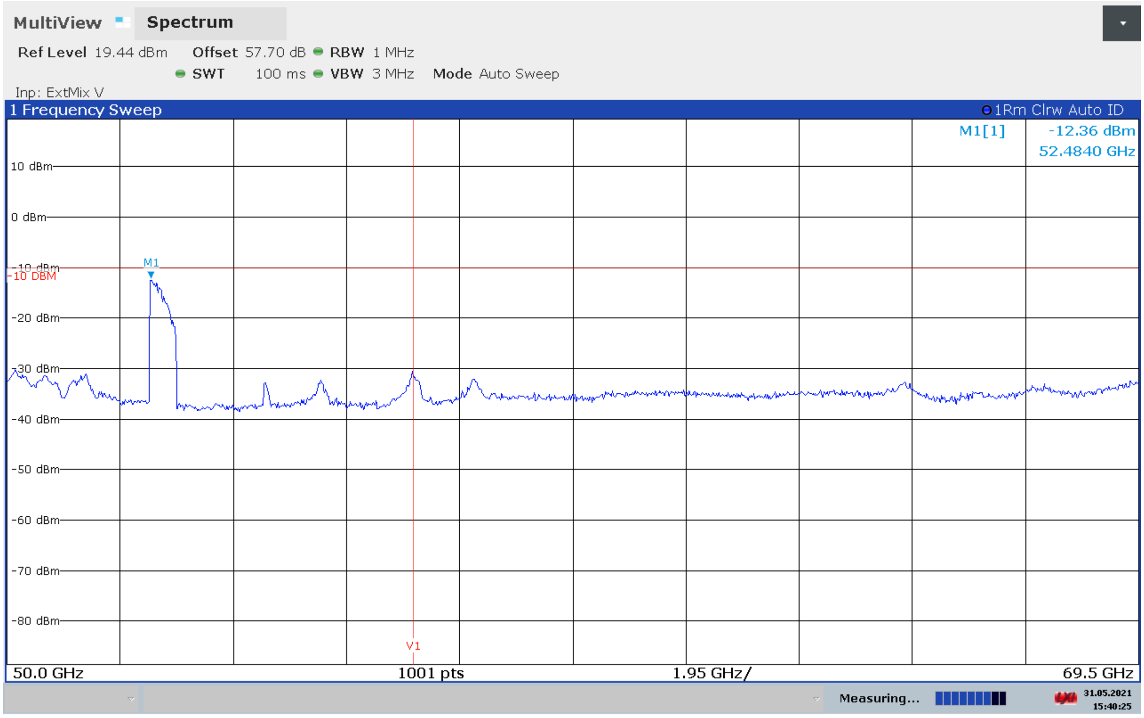


Plot 43: 40 GHz – 50 GHz, horizontal / vertical polarization



12:12:18 24.06.2021

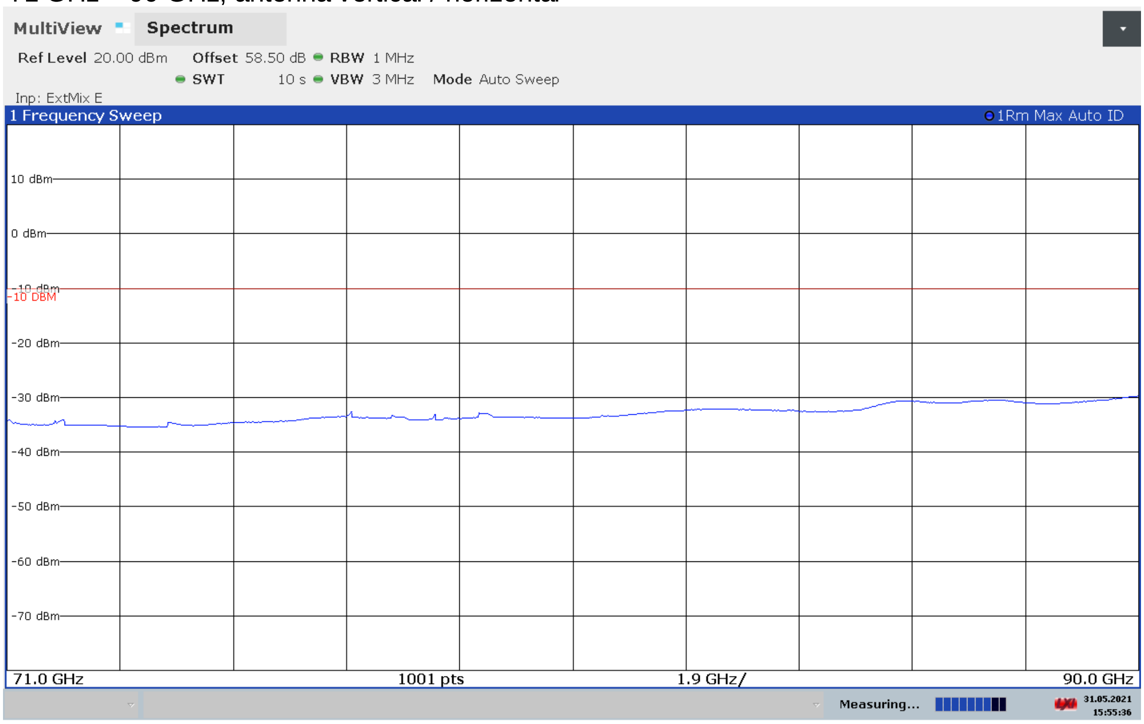
Plot 44: 50 GHz – 57 GHz, antenna vertical / horizontal



15:40:25 31.05.2021

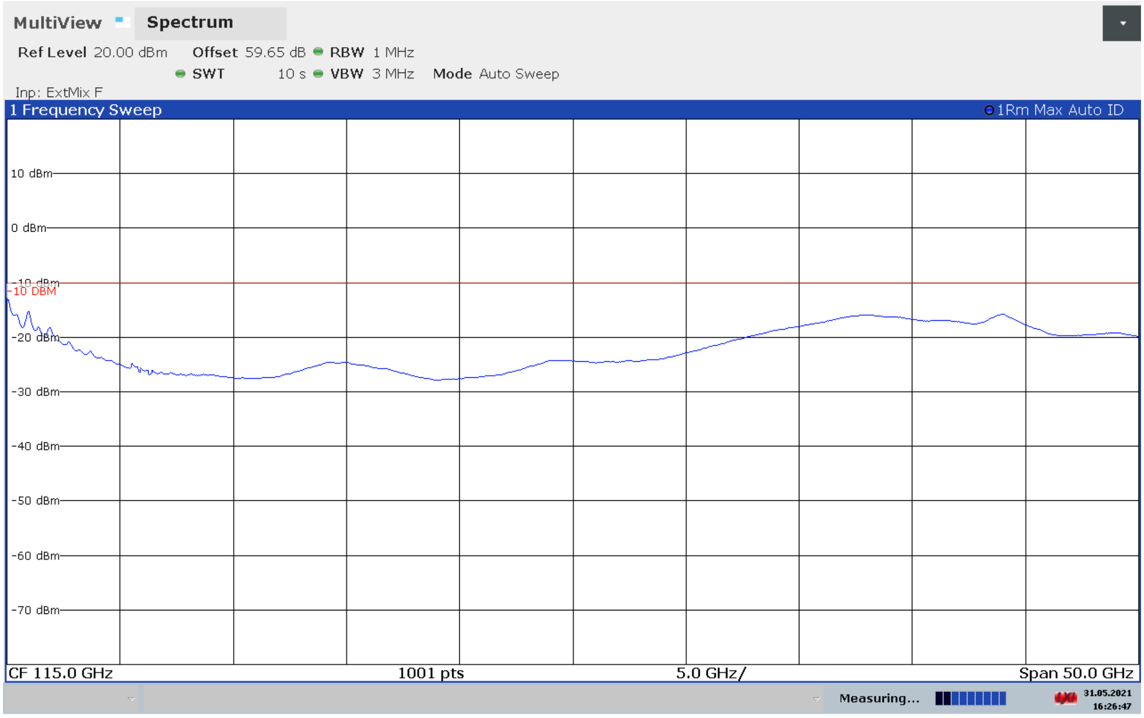
Note: mixer products visible on plot

Plot 45: 71 GHz – 90 GHz, antenna vertical / horizontal



15:55:36 31.05.2021

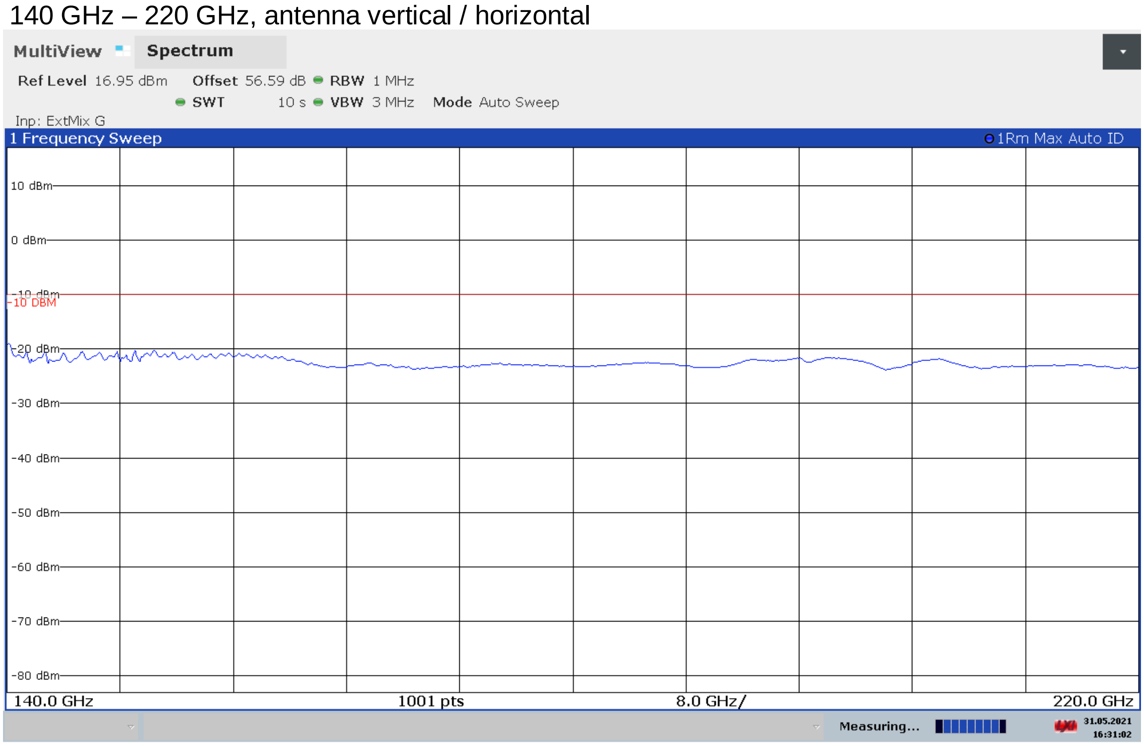
Plot 46: 90 GHz – 140 GHz, antenna vertical / horizontal



16:26:48 31.05.2021

Note: mixer products visible on plot

Plot 47: 140 GHz – 220 GHz, antenna vertical / horizontal



16:31:02 31.05.2021

11.5 Spurious emissions conducted < 30 MHz (AC power line)

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. Both power lines, phase and neutral line, are measured. Found peaks are re-measured with average and quasi peak detection to show compliance to the limits.

Measurement:

Measurement parameter	
Detector:	Peak - Quasi Peak / Average
Sweep time:	Auto
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max Hold

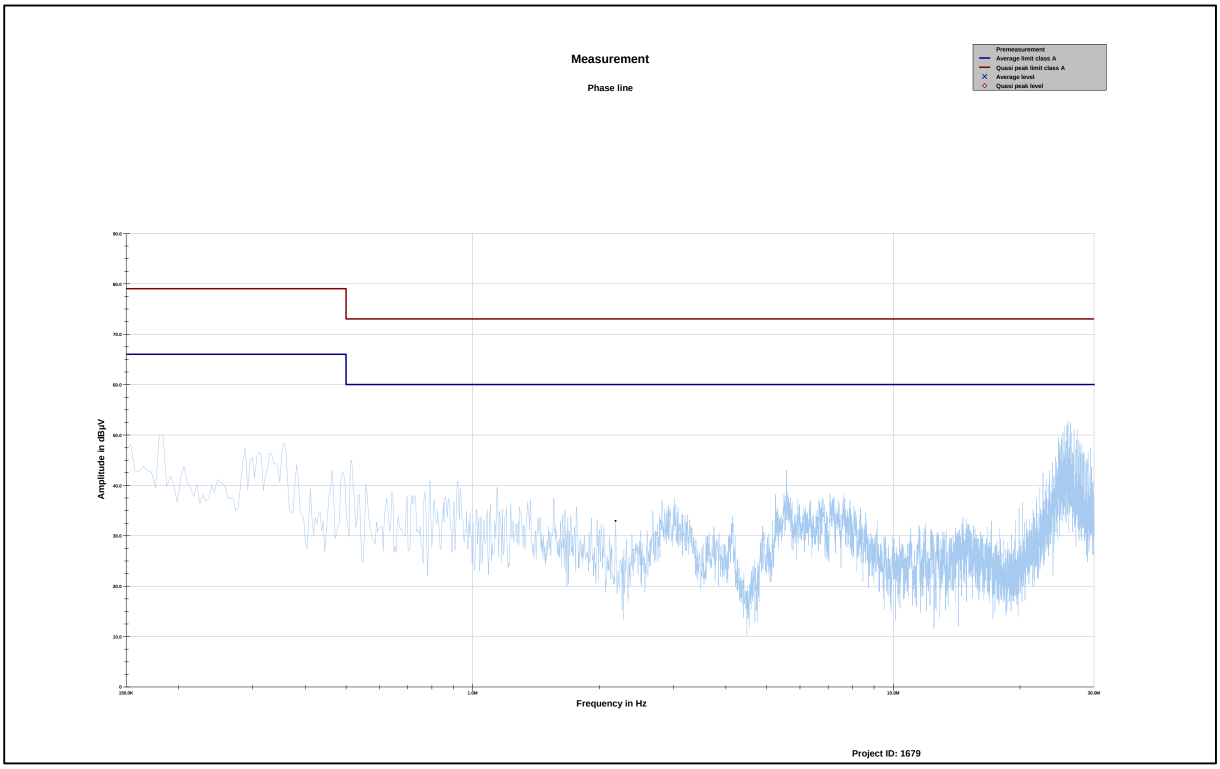
Limits:

FCC		IC
CFR Part 15.107 / 15.207(a)		RSS-Gen 8.8
Conducted Spurious Emissions < 30 MHz		
Frequency (MHz)	Quasi-Peak (dBµV/m)	Average (dBµV/m)
0.15 – 0.5	**79 (Class A)** 66 to 56* (Class B)	**66 (Class A)** 56 to 46* (Class B)
0.5 – 5	**73 (Class A)** 56 (Class B)	**63 (Class A)** 46 (Class B)
5 – 30.0	**73 (Class A)** 60 (Class B)	**63 (Class A)** 50 (Class B)

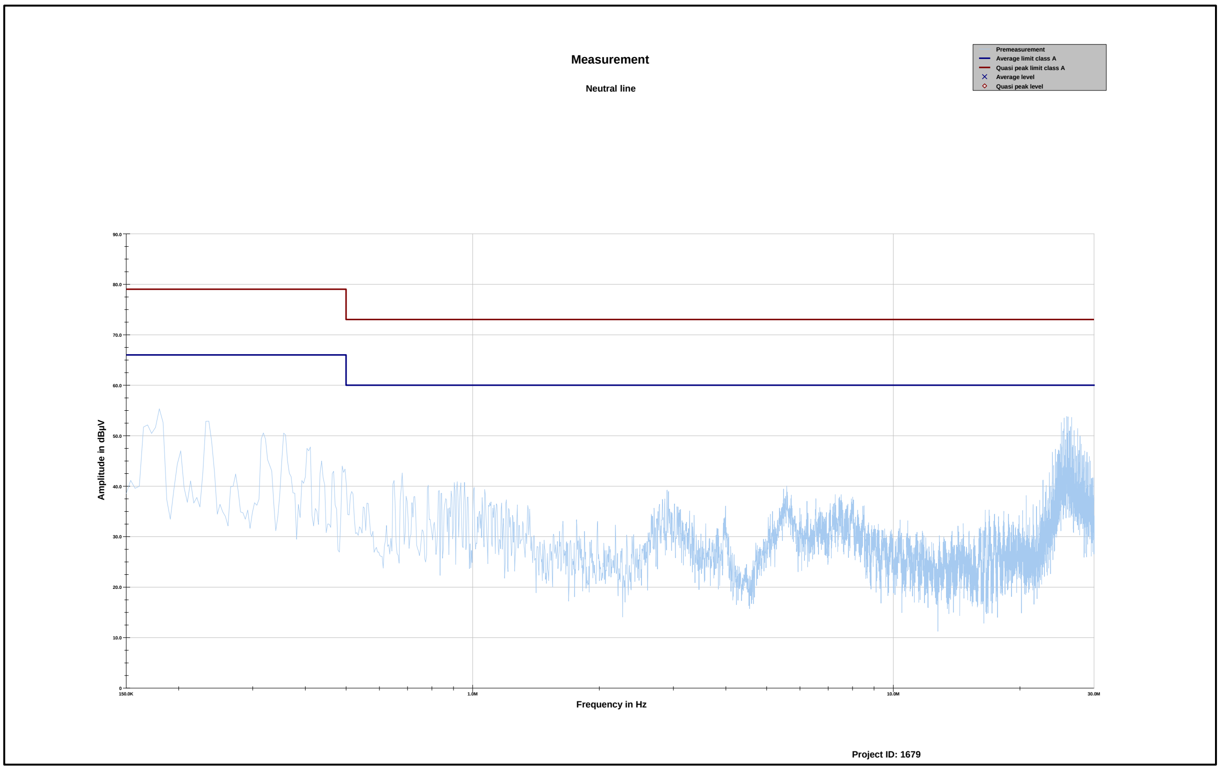
*Decreases with the logarithm of the frequency

Result: The measurement is passed for Class A limit

Plot No. 48: Phase line



Plot No. 49: Neutral line



11.6 Frequency Stability

Description:

§15.215(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range −20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

Measurement:

f_C is the point in the radiation where the power is at maximum. The frequency points where the power falls 10 dB below the f_C level and above f_C level are designated as f_L and f_H respectively.
The operating frequency range (i.e. the frequency band of operation) is defined as f_H - f_L.

Measurement parameter	
Detector:	Peak
Sweep time:	10 s
Resolution bandwidth:	2 MHz
Video bandwidth:	5 MHz
Span:	300 MHz
Trace-Mode:	Max Hold
Temperature:	-20 °C / +55 °C

Note: Occupied bandwidth measurements show the 192 kHz nominal bandwidth of the DOCSIS input signal generated by the R&S CLCD.
Low band edge was selected for low band frequency range, mid band for the middle frequency range and upper band edge for the higher frequency range.

Limits:

FCC	IC
CFR Part 15.255 (f)	RSS-Gen 6.11 / RSS-210 J.6
The occupied bandwidth from intentional radiators operated within the specified frequency band shall comply with the following:	
Frequency range	
57 GHz – 71 GHz	

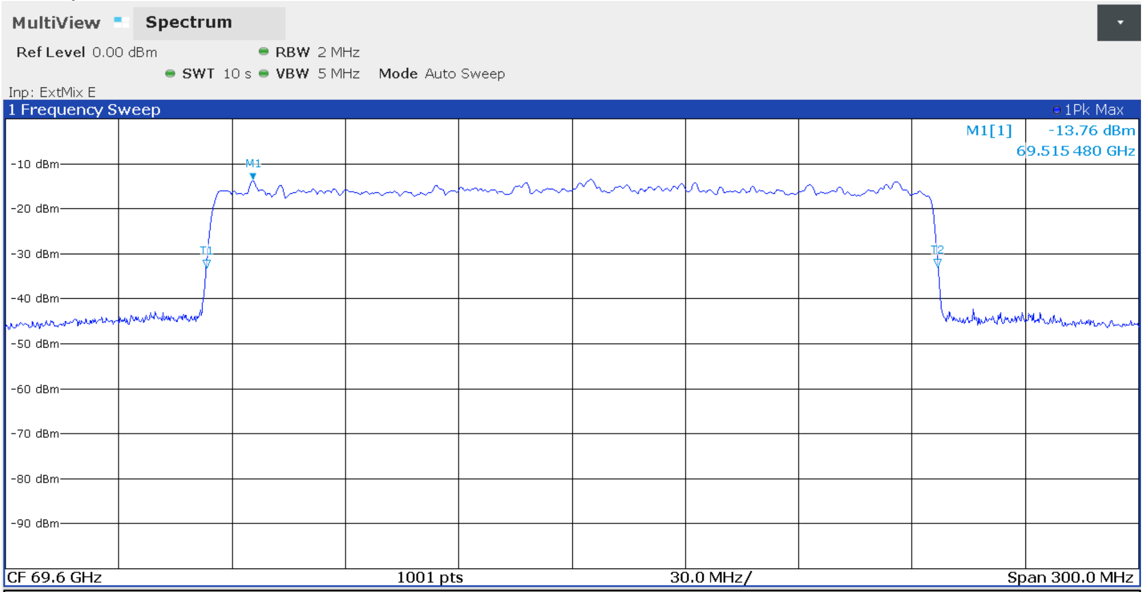
Measurement Results:

Test Conditions	Transmitter Frequency Range [GHz]		Occupied Bandwidth [MHz]
	f_L	f_H	
-20 °C / V_{nom}	69.503 2	69.696 8	193.61
-10 °C / V_{nom}	69.503 2	69.696 8	193.61
0 °C / V_{nom}	69.503 2	69.696 8	193.61
10 °C / V_{nom}	69.503 2	69.696 8	193.61
20 °C / V_{min}	69.503 2	69.696 8	193.61
20 °C / V_{nom}	69.503 2	69.696 8	193.61
20 °C / V_{max}	69.503 2	69.696 8	193.61
30 °C / V_{nom}	69.503 2	69.696 8	193.61
40 °C / V_{nom}	69.503 2	69.696 8	193.61
50 °C / V_{nom}	69.503 2	69.696 8	193.61
55 °C / V_{nom}	69.503 2	69.696 8	193.61
-20 °C / V_{nom}	70.153 2	70.346 2	193.01
-10 °C / V_{nom}	70.153 2	70.346 5	193.31
0 °C / V_{nom}	70.153 2	70.346 8	193.61
10 °C / V_{nom}	70.153 2	70.346 5	193.31
20 °C / V_{min}	70.152 9	70.346 8	193.91
20 °C / V_{nom}	70.153 2	70.346 8	193.61
20 °C / V_{max}	70.152 9	70.346 8	193.91
30 °C / V_{nom}	70.153 2	70.346 8	193.61
40 °C / V_{nom}	70.153 2	70.346 8	193.61
50 °C / V_{nom}	70.153 2	70.346 8	193.61
55 °C / V_{nom}	70.153 2	70.346 5	193.31
-20 °C / V_{nom}	70.803 2	70.996 2	193.01
-10 °C / V_{nom}	70.803 2	70.996 2	193.01
0 °C / V_{nom}	70.803 2	70.996 2	193.01
10 °C / V_{nom}	70.803 2	70.996 2	193.01
20 °C / V_{min}	70.803 2	70.996 2	193.01
20 °C / V_{nom}	70.803 2	70.996 2	193.01
20 °C / V_{max}	70.803 2	70.996 2	193.01
30 °C / V_{nom}	70.803 2	70.996 2	193.01
40 °C / V_{nom}	70.803 2	70.996 2	193.01
50 °C / V_{nom}	70.803 2	70.996 2	193.01
55 °C / V_{nom}	70.803 2	70.996 2	193.01

Result: **The measurement is passed.**

Plots of lower frequency range

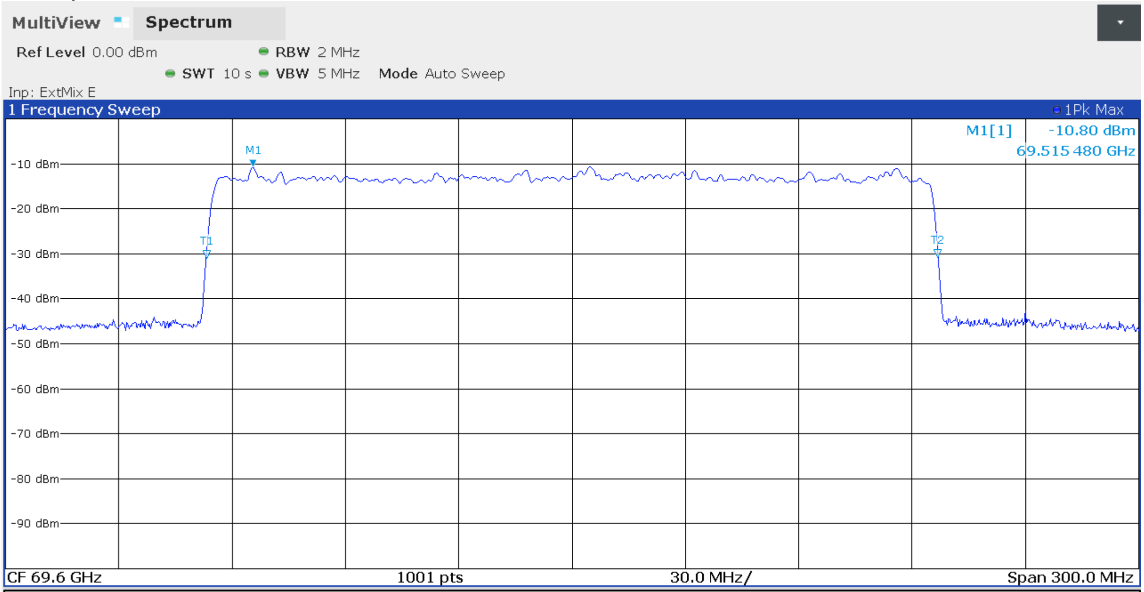
Plot 50: Occupied Bandwidth for lower at -20 °C / V_{nom}



Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**69.515 48 GHz**	**-13.76 dBm**	ndB	20.0 dB
T1		1	69.503 2 GHz	-33.19 dBm	ndB down BW	**193.61 MHz**
T2		1	69.696 8 GHz	-33.02 dBm	Q Factor	359.1

14:45:14 02.06.2021

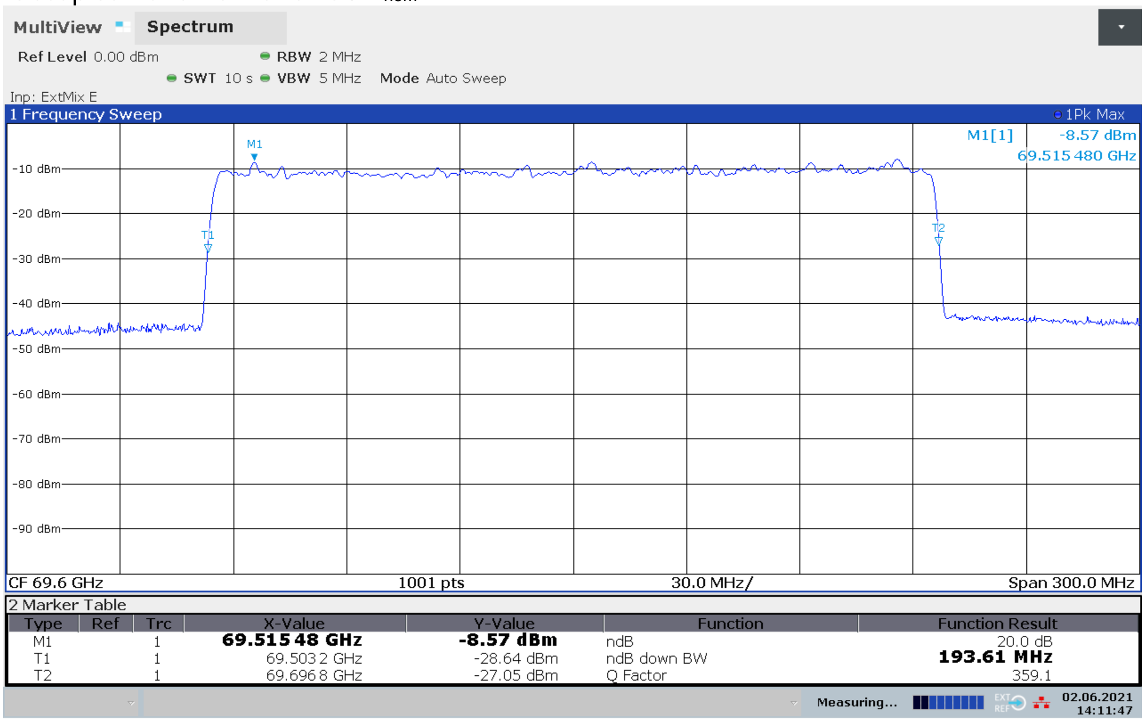
Plot 51: Occupied Bandwidth at -10 °C / V_{nom}



Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**69.515 48 GHz**	**-10.80 dBm**	ndB	20.0 dB
T1		1	69.503 2 GHz	-30.93 dBm	ndB down BW	**193.61 MHz**
T2		1	69.696 8 GHz	-30.86 dBm	Q Factor	359.1

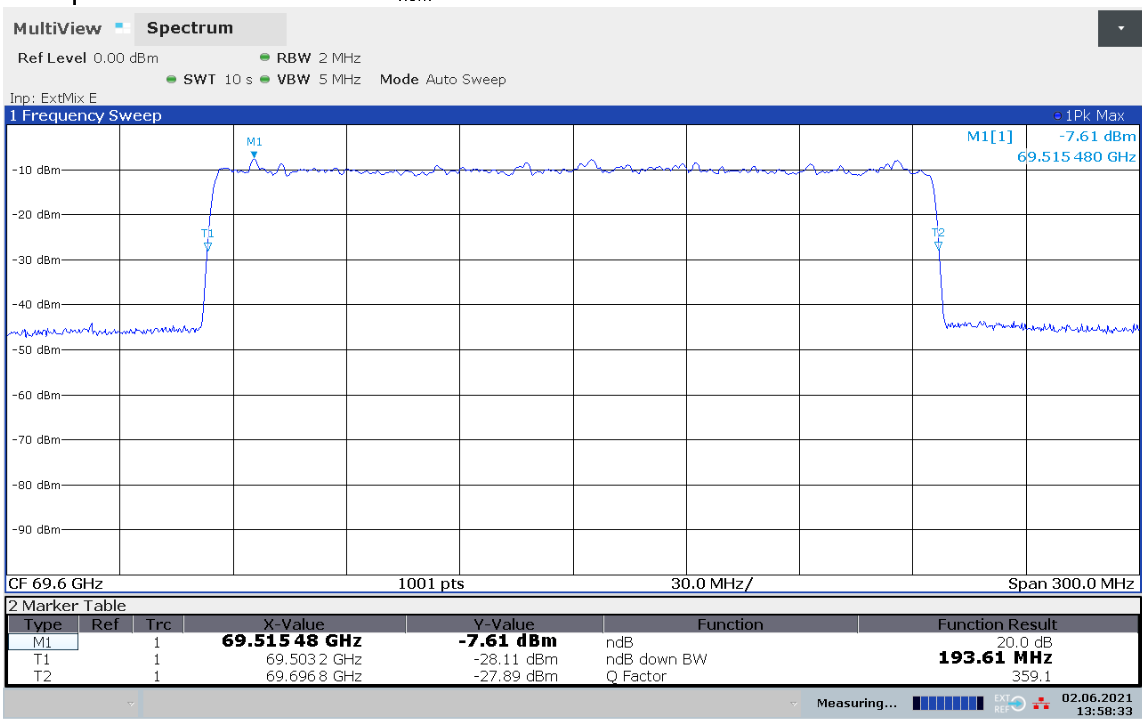
14:23:51 02.06.2021

Plot 52: Occupied Bandwidth at 0 °C / V_{nom}



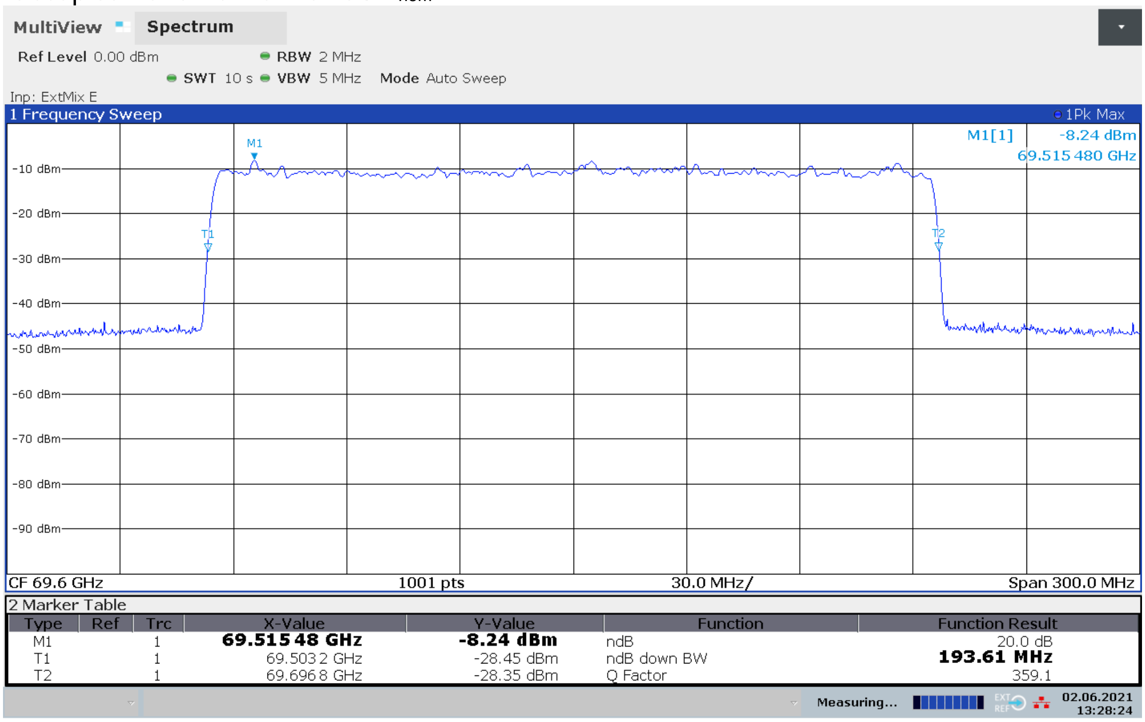
14:11:48 02.06.2021

Plot 53: Occupied Bandwidth at 10 °C / V_{nom}



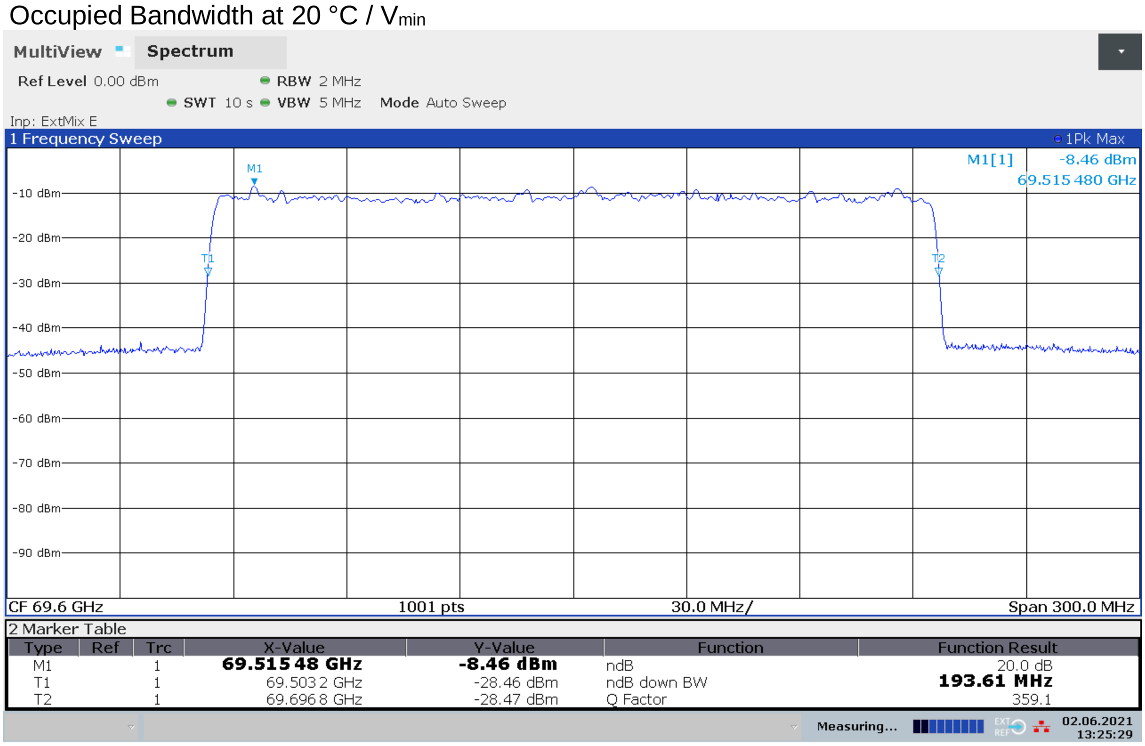
13:58:33 02.06.2021

Plot 54: Occupied Bandwidth at 20 °C / V_{nom}



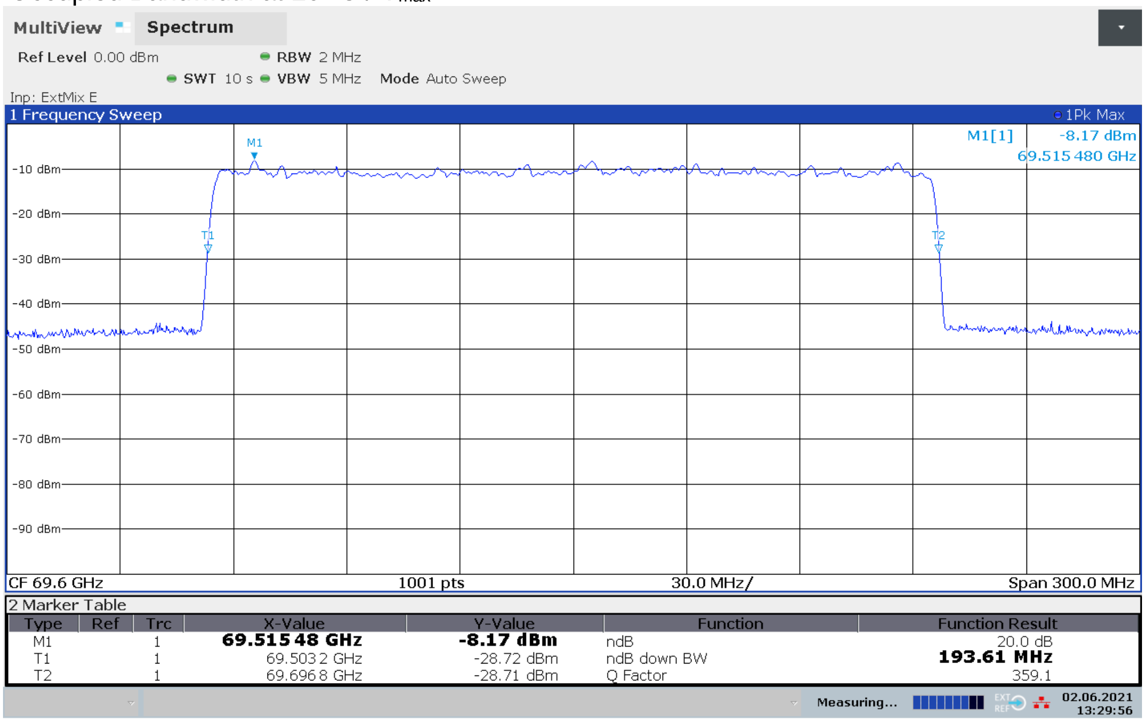
13:28:25 02.06.2021

Plot 55: Occupied Bandwidth at 20 °C / V_{min}



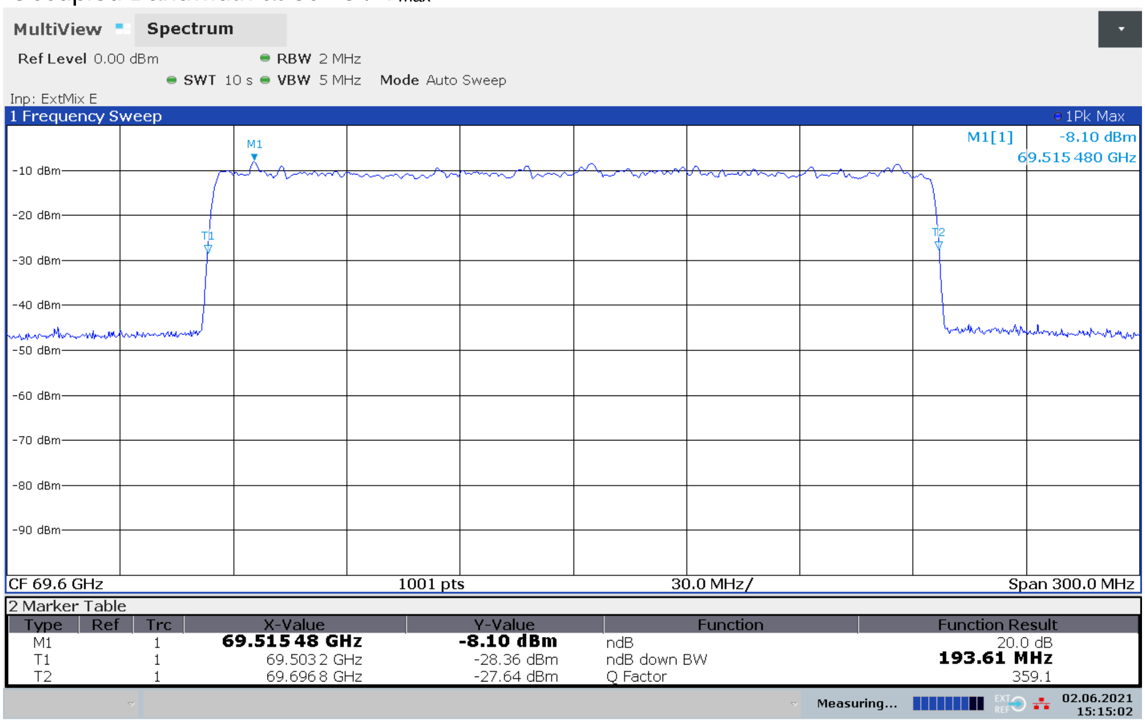
13:25:29 02.06.2021

Plot 56: Occupied Bandwidth at 20 °C / V_{max}



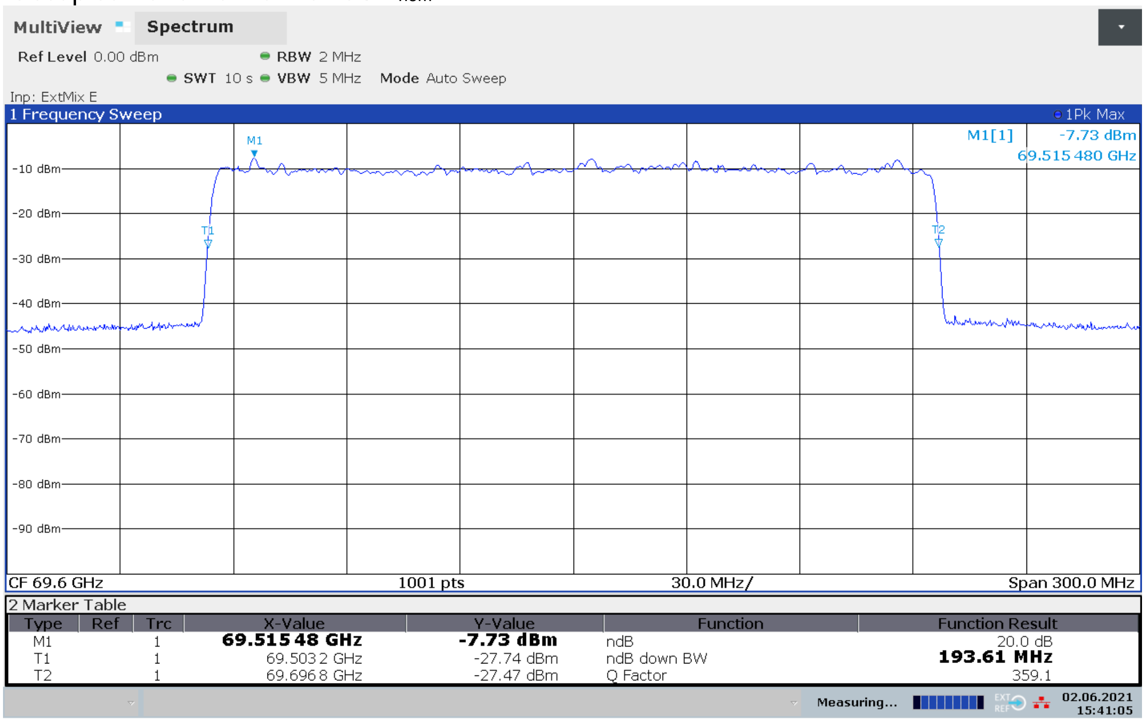
13:29:56 02.06.2021

Plot 57: Occupied Bandwidth at 30 °C / V_{max}



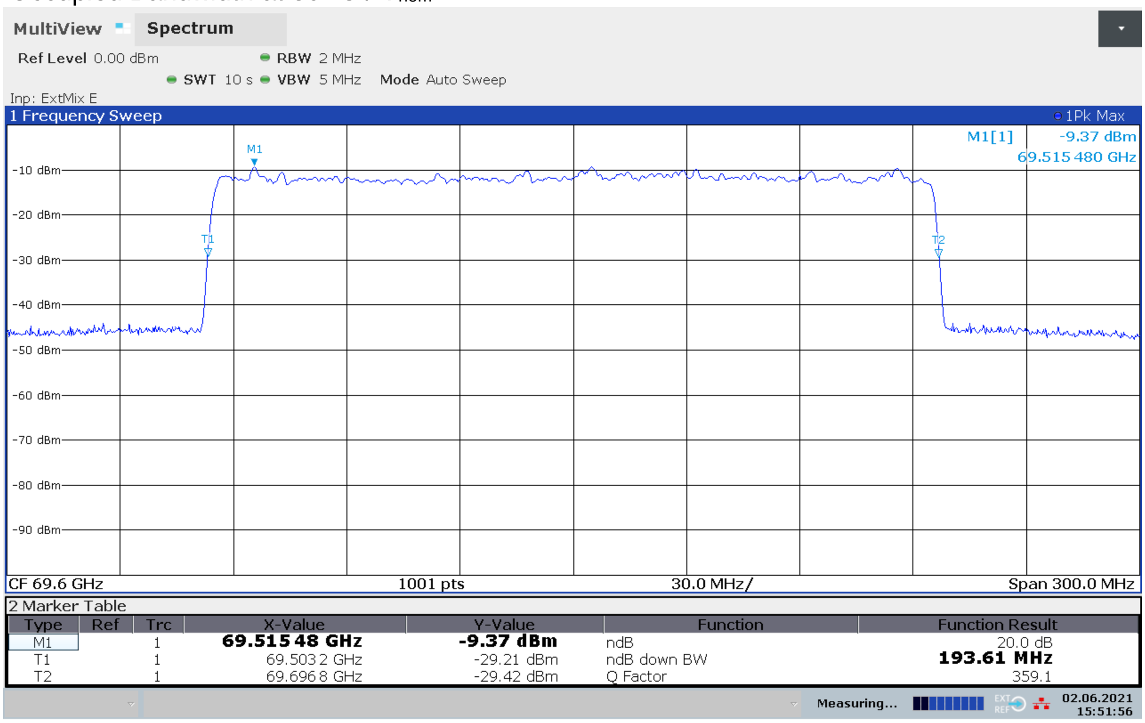
15:15:03 02.06.2021

Plot 58: Occupied Bandwidth at 40 °C / V_{nom}



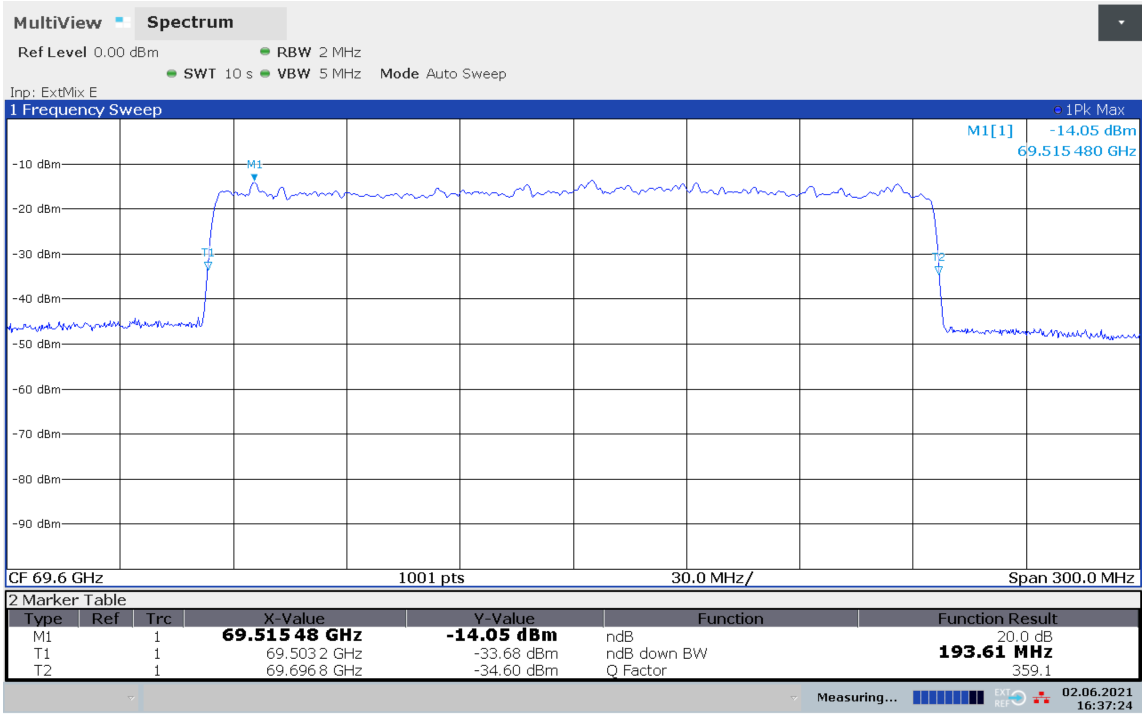
15:41:05 02.06.2021

Plot 59: Occupied Bandwidth at 50 °C / V_{nom}



15:51:57 02.06.2021

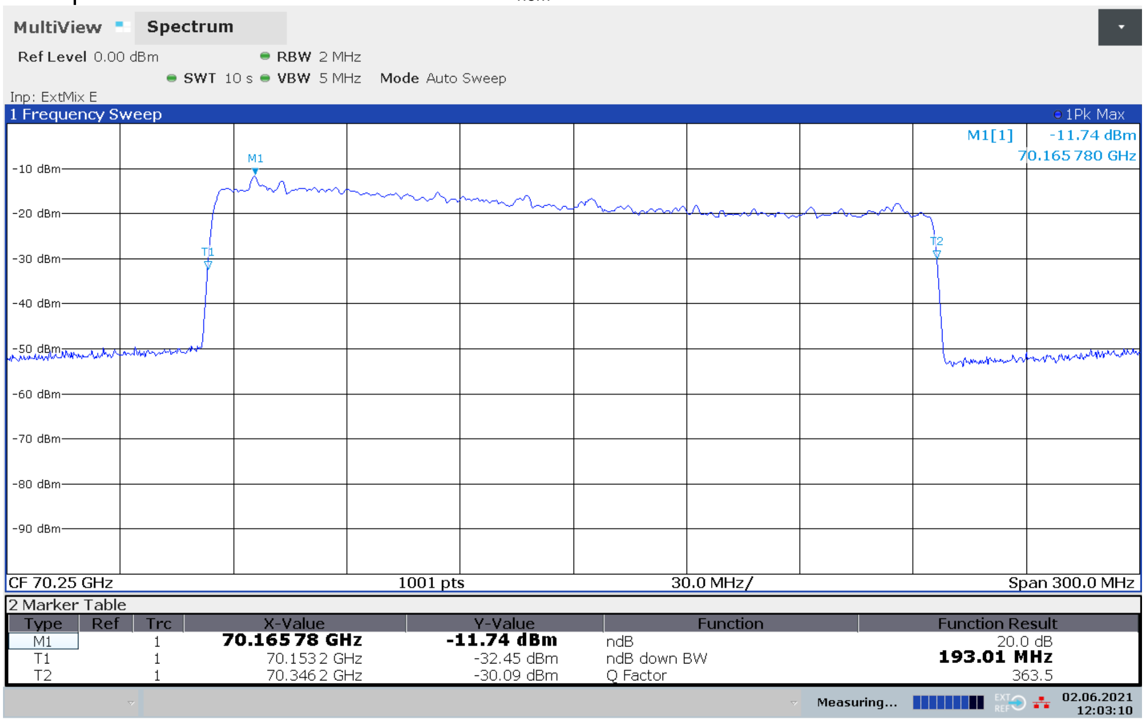
Plot 60: Occupied Bandwidth at 55 °C / V_{nom}



16:37:25 02.06.2021

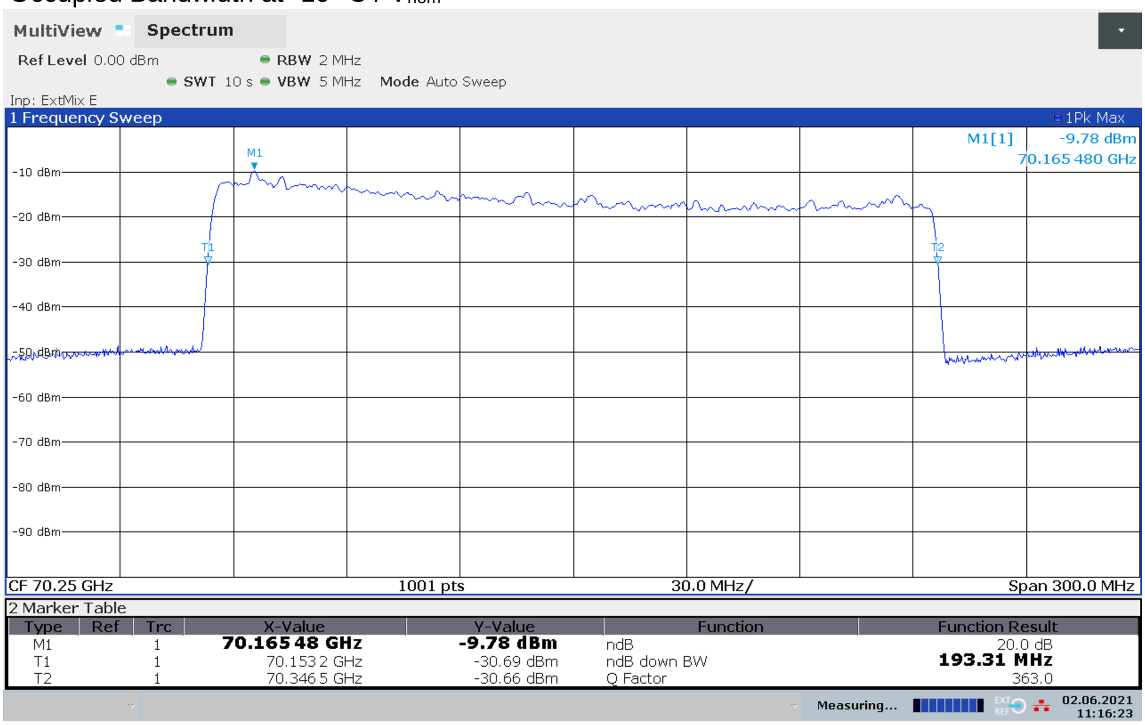
Plots of middle frequency range

Plot 61: Occupied Bandwidth for lower at -20 °C / V_{nom}



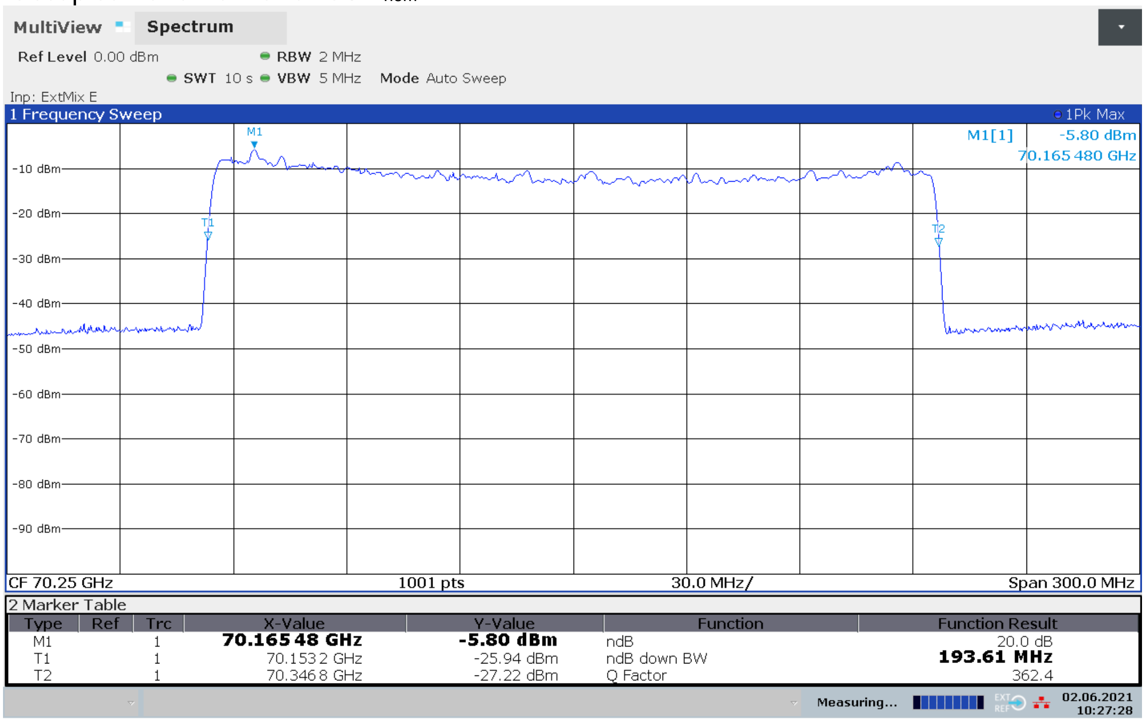
12:03:11 02.06.2021

Plot 62: Occupied Bandwidth at -10 °C / V_{nom}



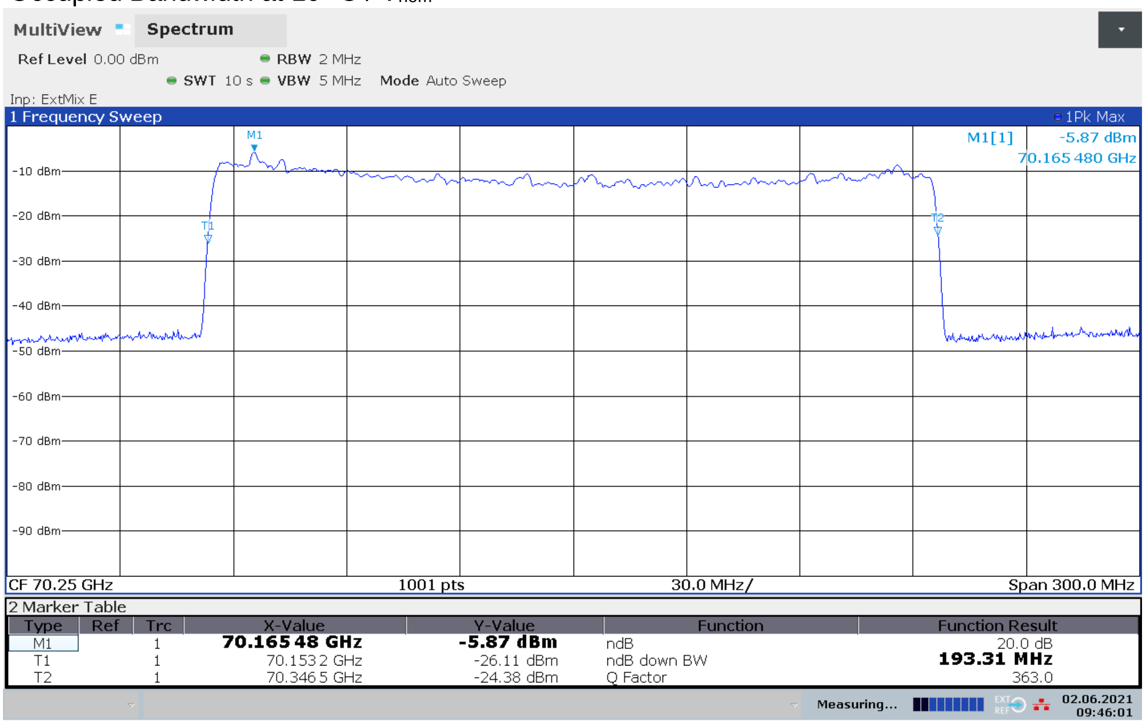
11:16:24 02.06.2021

Plot 63: Occupied Bandwidth at 0 °C / V_{nom}



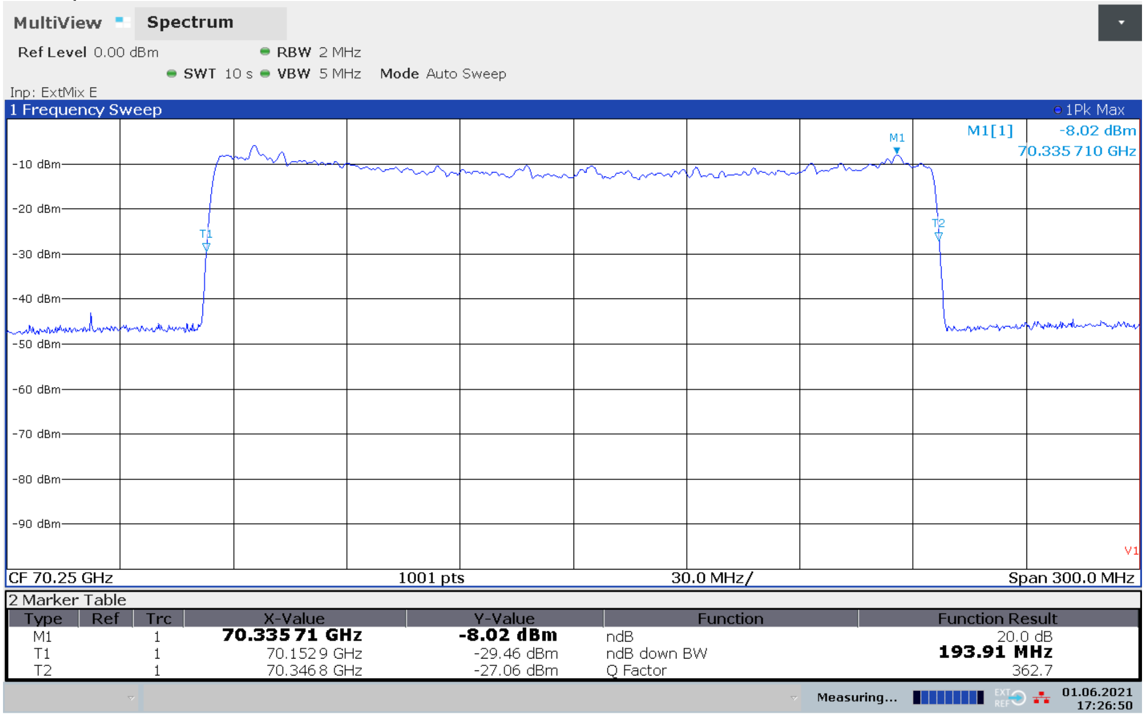
10:27:28 02.06.2021

Plot 64: Occupied Bandwidth at 10 °C / V_{nom}



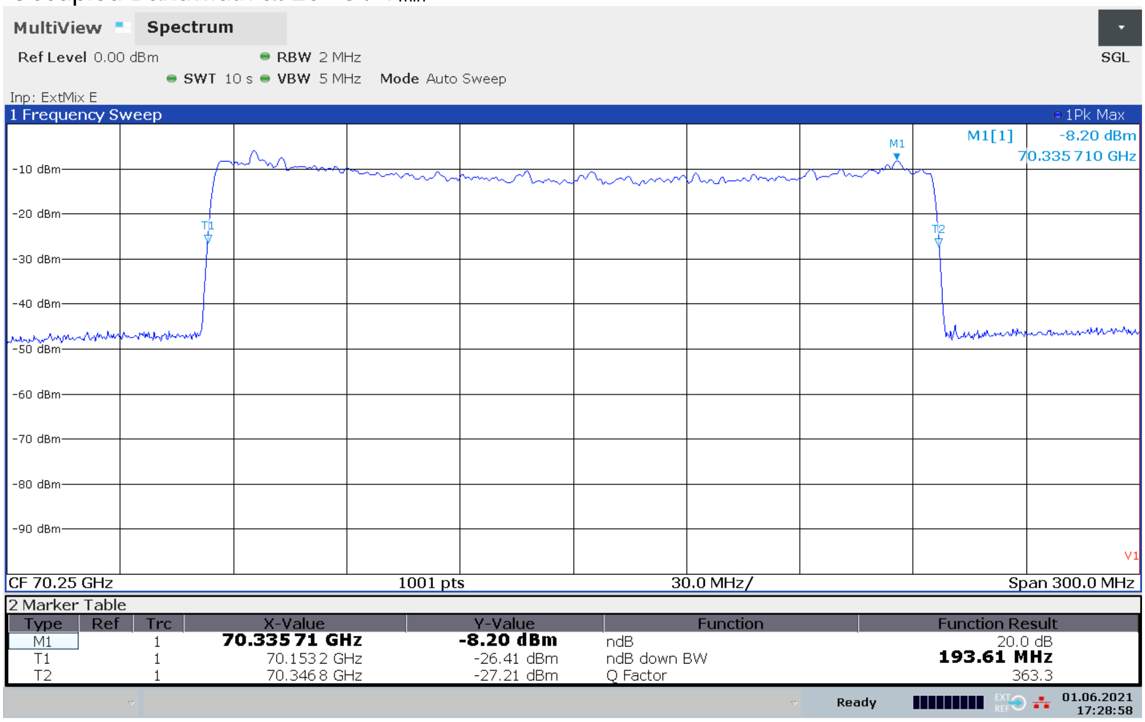
09:46:01 02.06.2021

Plot 65: Occupied Bandwidth at 20 °C / V_{nom}



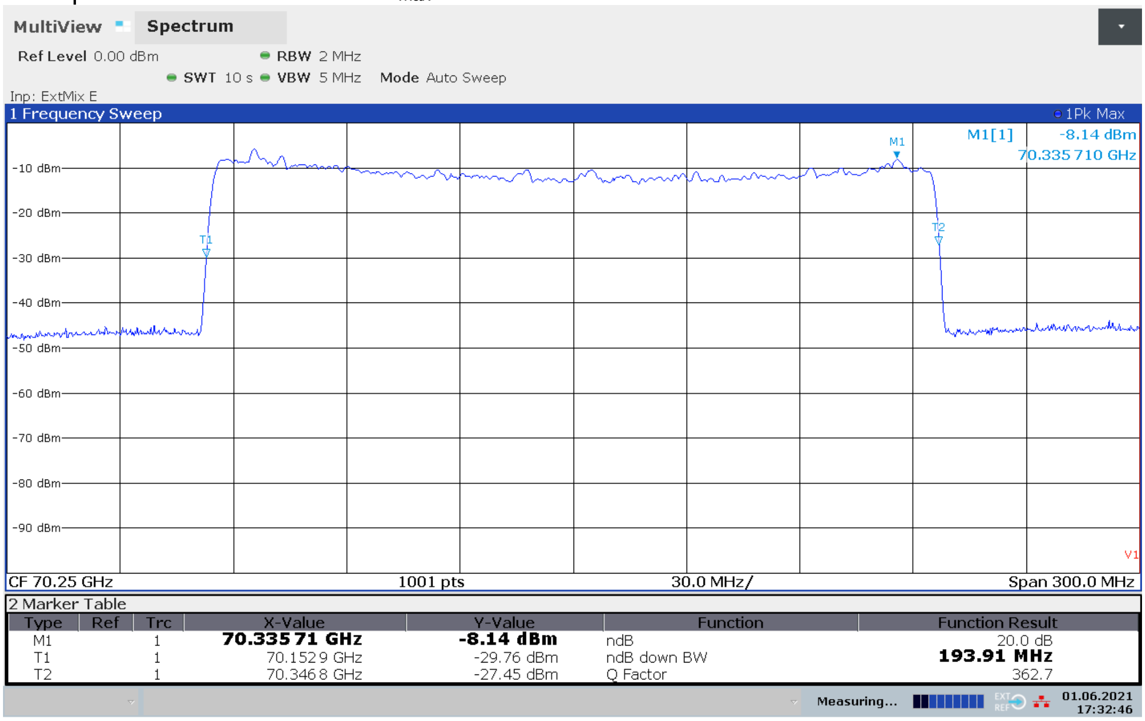
17:26:51 01.06.2021

Plot 66: Occupied Bandwidth at 20 °C / V_{min}



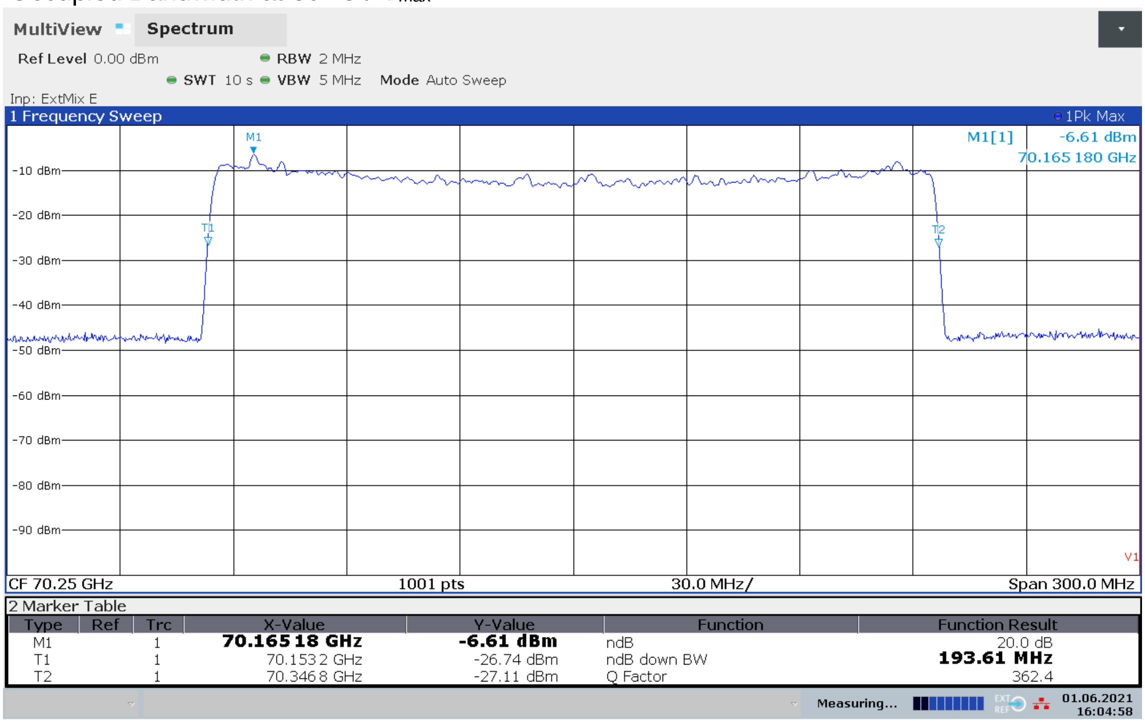
17:28:59 01.06.2021

Plot 67: Occupied Bandwidth at 20 °C / V_{max}



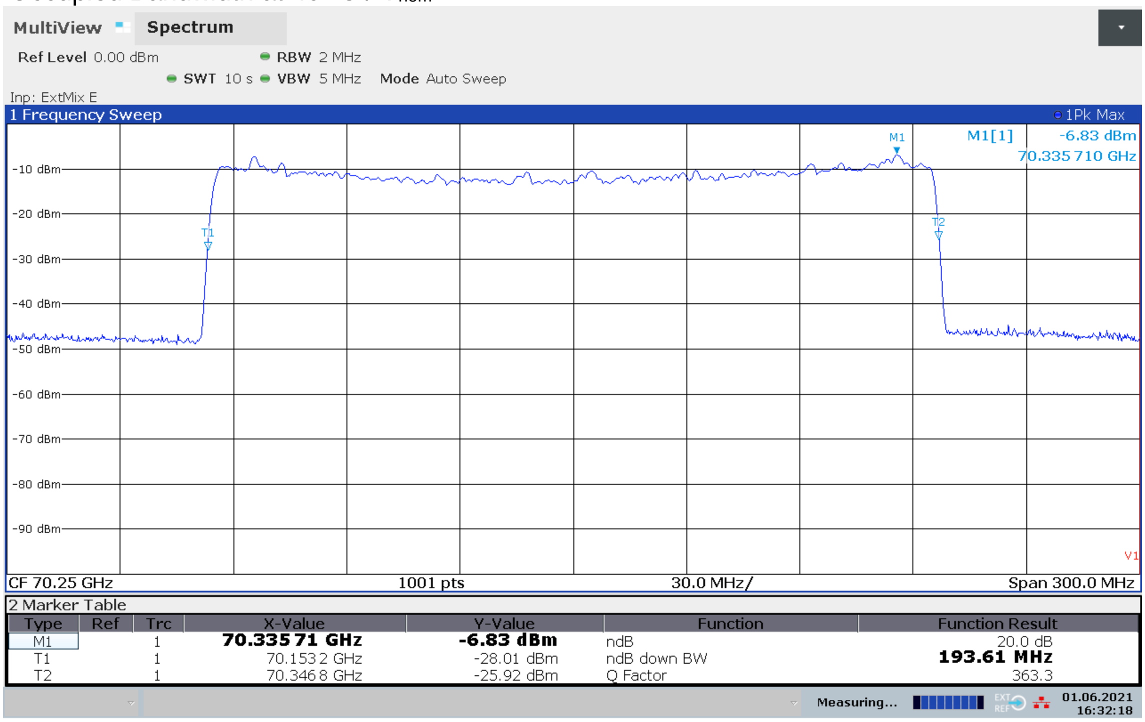
17:32:47 01.06.2021

Plot 68: Occupied Bandwidth at 30 °C / V_{max}



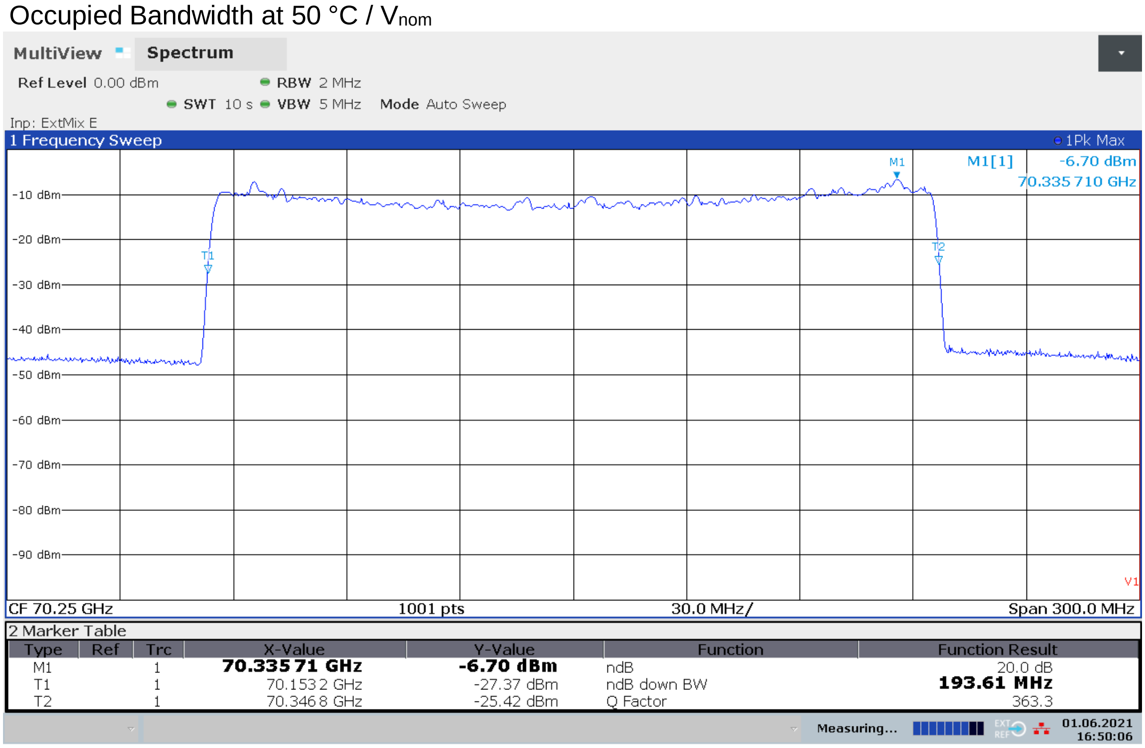
16:04:58 01.06.2021

Plot 69: Occupied Bandwidth at 40 °C / V_{nom}



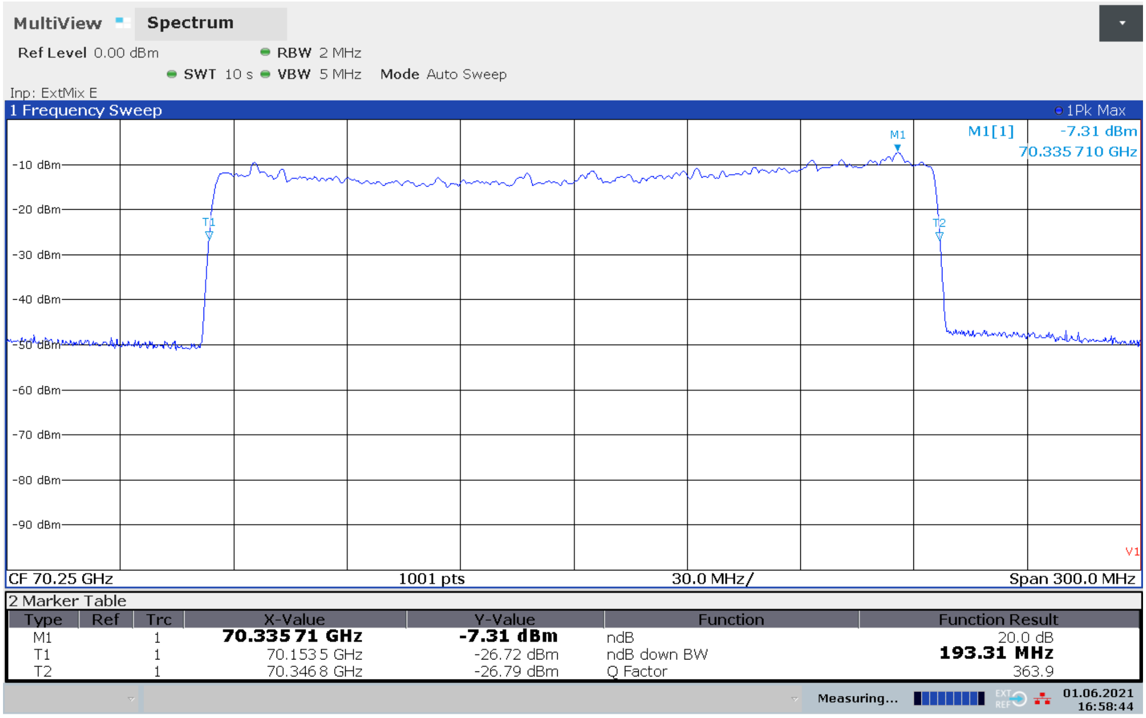
16:32:18 01.06.2021

Plot 70: Occupied Bandwidth at 50 °C / V_{nom}



16:50:07 01.06.2021

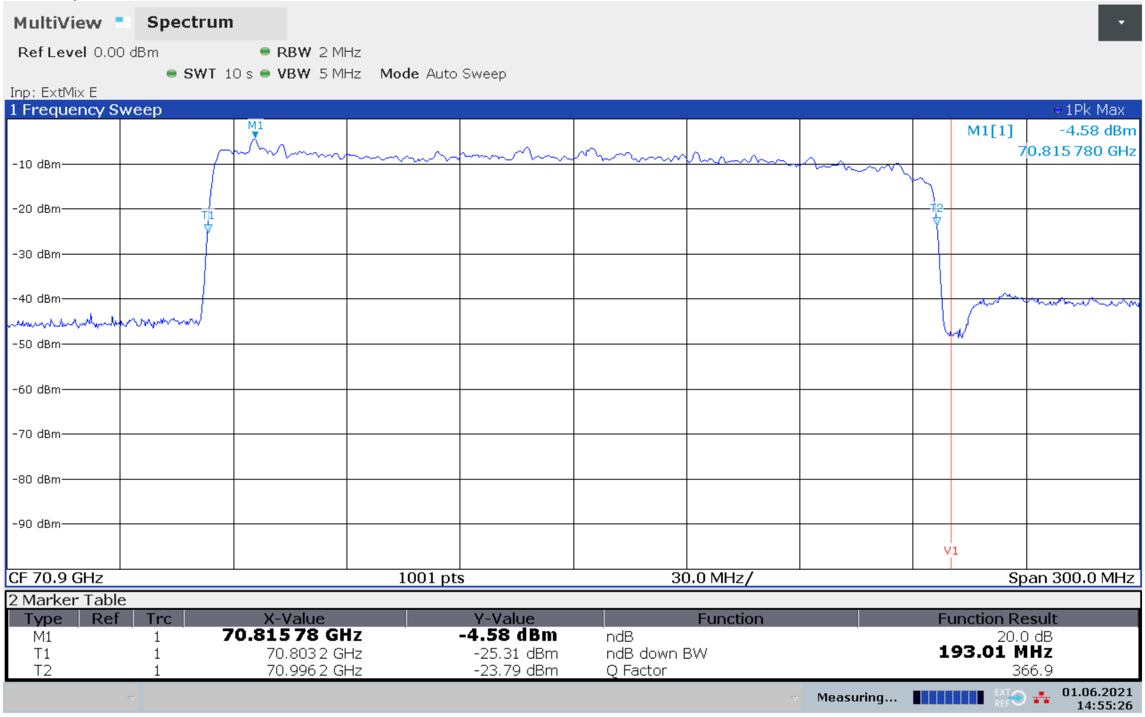
Plot 71: Occupied Bandwidth at 55 °C / V_{nom}



16:58:45 01.06.2021

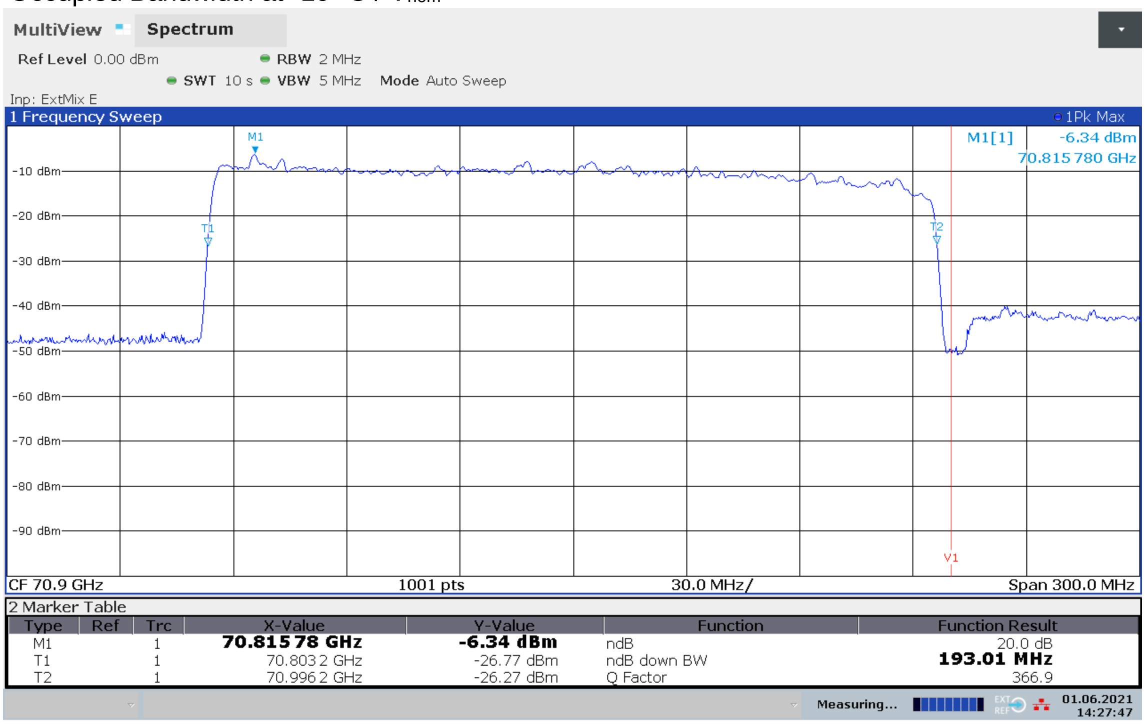
Plots of higher frequency range

Plot 72: Occupied Bandwidth for lower at -20 °C / V_{nom}



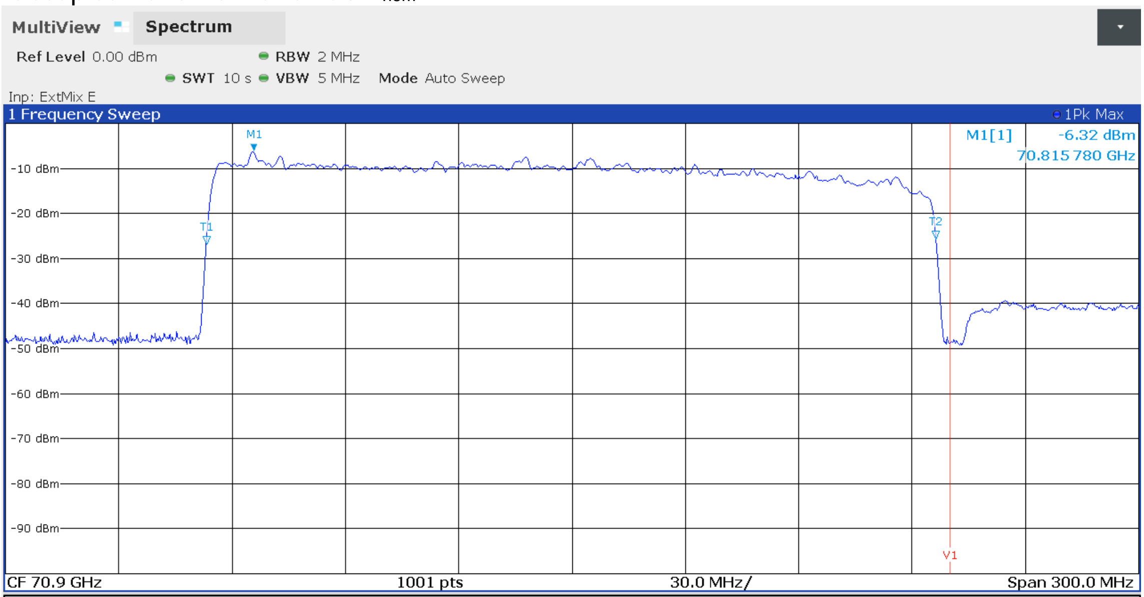
14:55:26 01.06.2021

Plot 73: Occupied Bandwidth at -10 °C / V_{nom}



14:27:47 01.06.2021

Plot 74: Occupied Bandwidth at 0 °C / V_{nom}

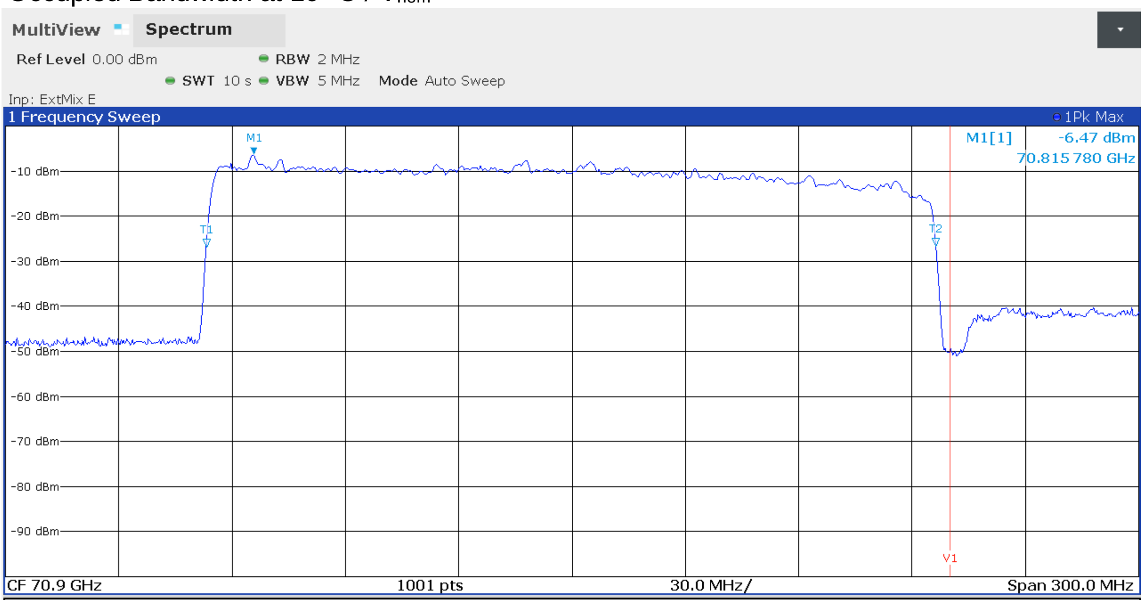


Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	70.815 78 GHz	-6.32 dBm	ndB	20.0 dB
T1		1	70.803 2 GHz	-26.83 dBm	ndB down BW	193.01 MHz
T2		1	70.996 2 GHz	-25.60 dBm	Q Factor	366.9

Measuring... 01.06.2021 13:51:10

13:51:10 01.06.2021

Plot 75: Occupied Bandwidth at 10 °C / V_{nom}

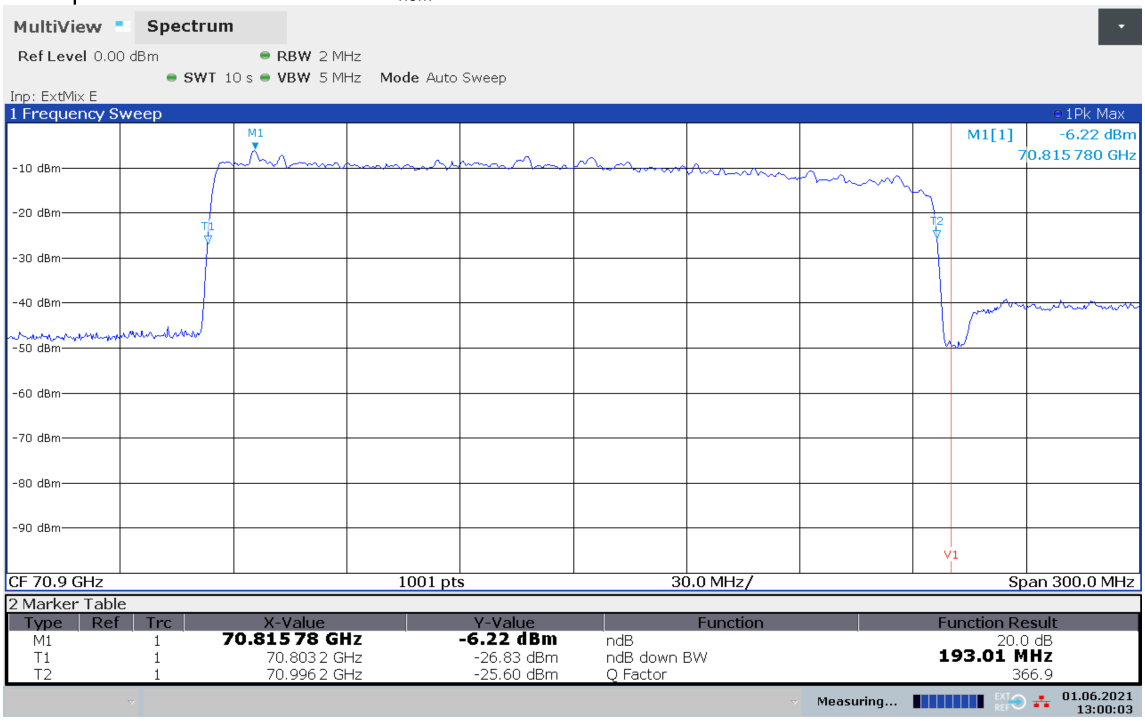


Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	70.815 78 GHz	-6.47 dBm	ndB	20.0 dB
T1		1	70.803 2 GHz	-26.96 dBm	ndB down BW	193.01 MHz
T2		1	70.996 2 GHz	-26.73 dBm	Q Factor	366.9

Measuring... 01.06.2021 13:33:31

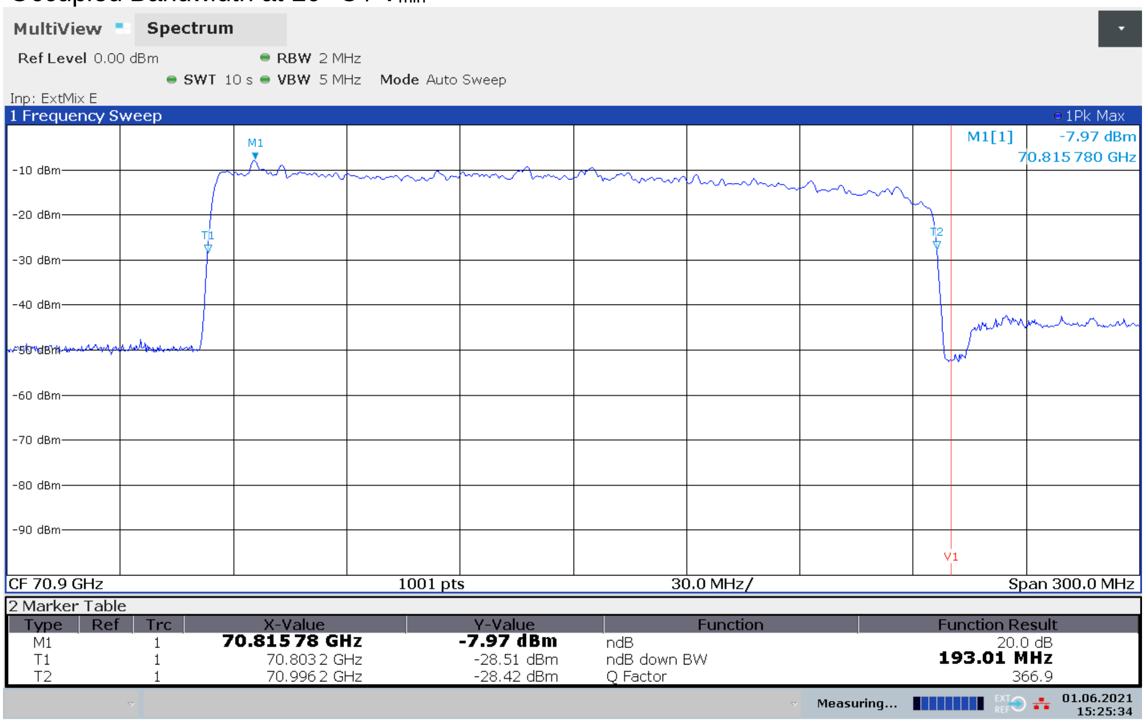
13:33:31 01.06.2021

Plot 76: Occupied Bandwidth at 20 °C / V_{nom}



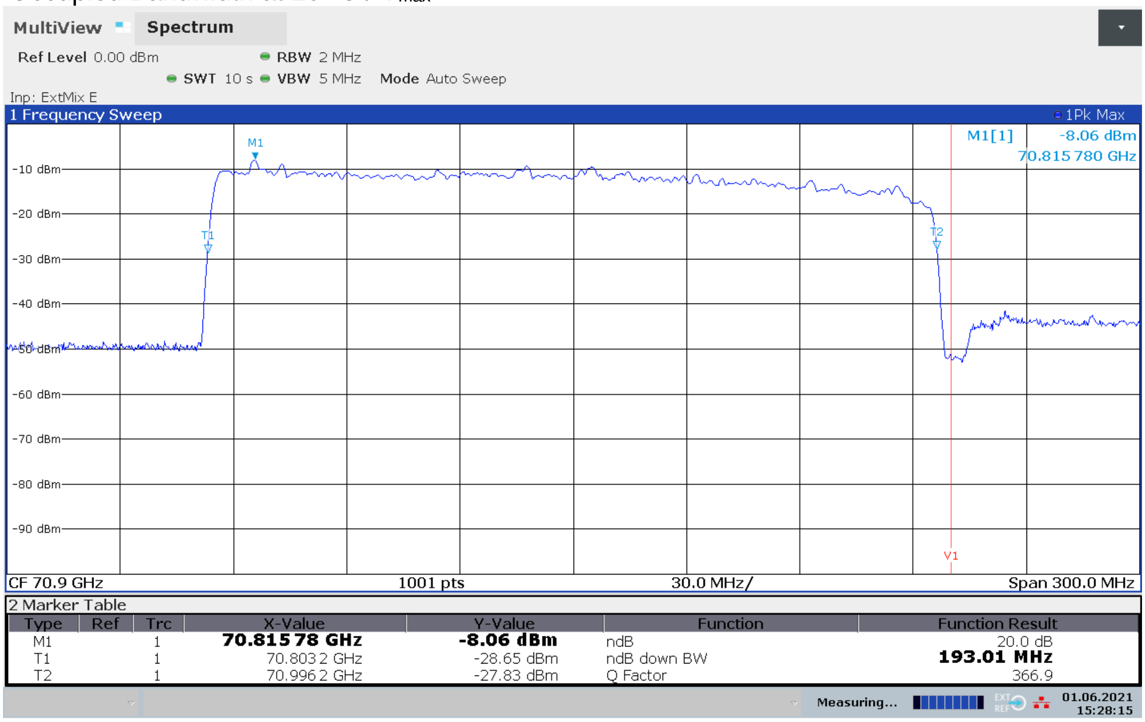
13:00:03 01.06.2021

Plot 77: Occupied Bandwidth at 20 °C / V_{min}



15:25:35 01.06.2021

Plot 78: Occupied Bandwidth at 20 °C / V_{max}

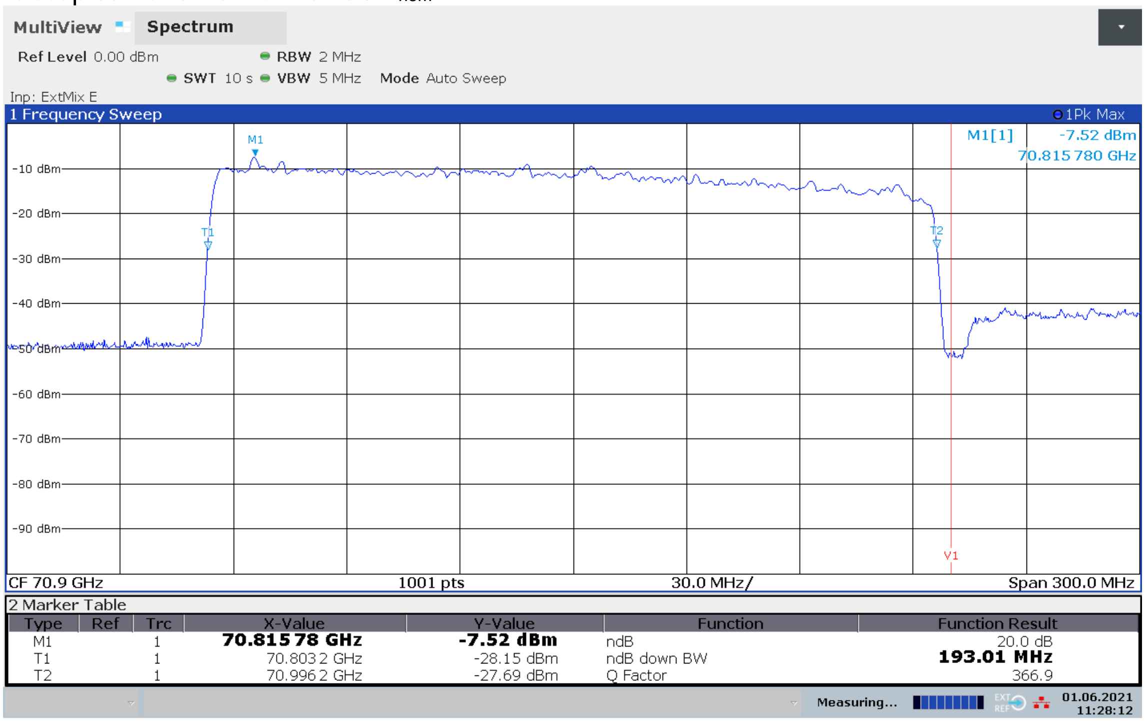


15:28:15 01.06.2021

Plot 79: Occupied Bandwidth at 30 °C / V_{max}

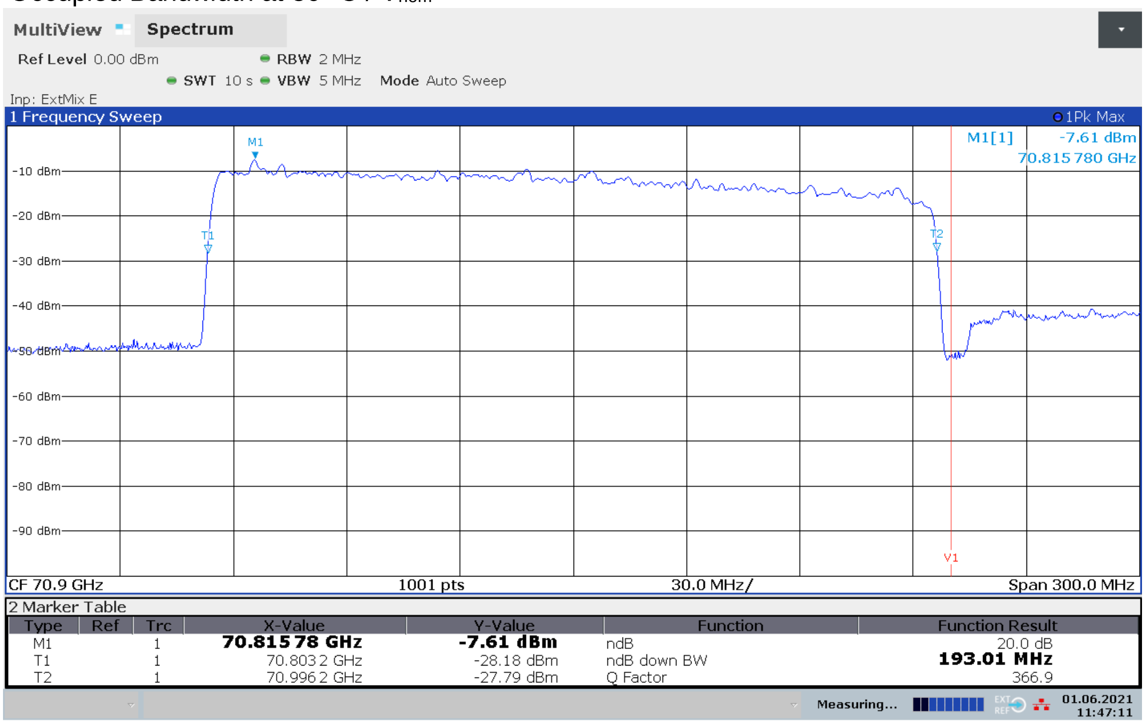
11:08:09 01.06.2021

Plot 80: Occupied Bandwidth at 40 °C / V_{nom}



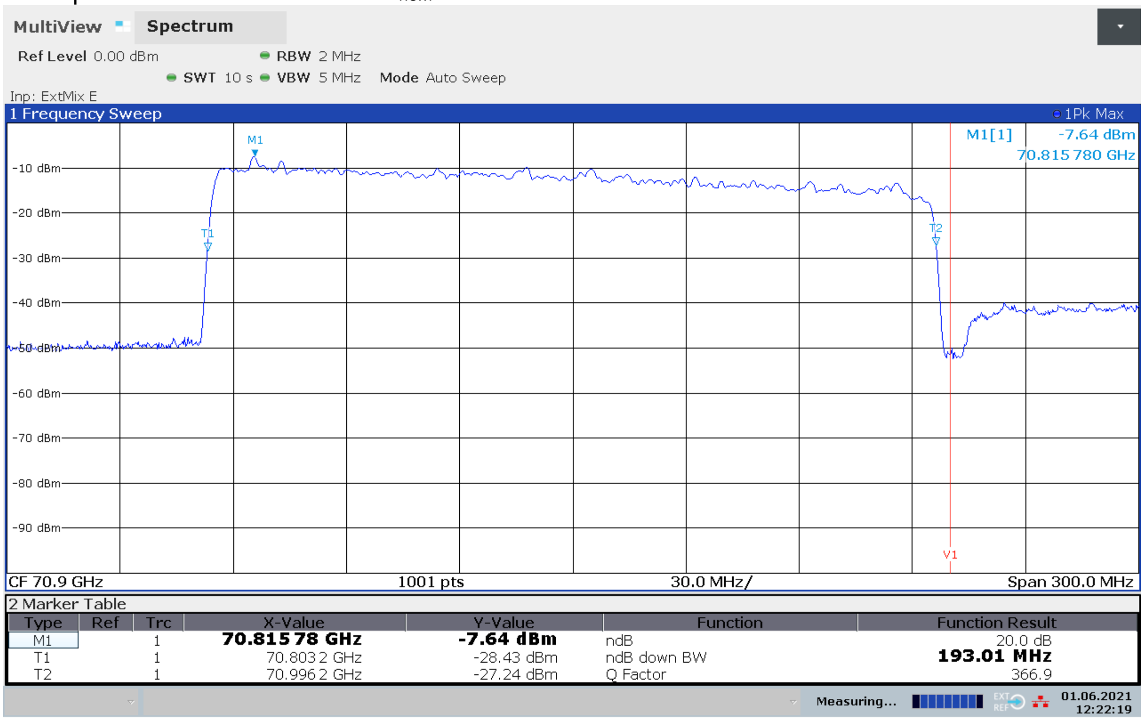
11:28:13 01.06.2021

Plot 81: Occupied Bandwidth at 50 °C / V_{nom}



11:47:12 01.06.2021

Plot 82: Occupied Bandwidth at 55 °C / V_{nom}



12:22:20 01.06.2021

11.7 Simultaneous operation

Description:

§15.255 (h) Any transmitter that has received the necessary FCC equipment authorization under the rules of this chapter may be mounted in a group installation for simultaneous operation with one or more other transmitter(s) that have received the necessary FCC equipment authorization, without any additional equipment authorization. However, no transmitter operating under the provisions of this section may be equipped with external phase-locking inputs that permit beam-forming arrays to be realized.

Result: No beamforming in use

12 Glossary

EUT	Equipment under test
DUT	Device under test
UUT	Unit under test
GUE	GNSS User Equipment
ETSI	European Telecommunications Standards Institute
EN	European Standard
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
IC	Industry Canada
PMN	Product marketing name
HMN	Host marketing name
HVIN	Hardware version identification number
FVIN	Firmware version identification number
EMC	Electromagnetic Compatibility
HW	Hardware
SW	Software
Inv. No.	Inventory number
S/N or SN	Serial number
C	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed
PP	Positive peak
QP	Quasi peak
AVG	Average
OC	Operating channel
OCW	Operating channel bandwidth
OBW	Occupied bandwidth
OOB	Out of band
DFS	Dynamic frequency selection
CAC	Channel availability check
OP	Occupancy period
NOP	Non occupancy period
DC	Duty cycle
PER	Packet error rate
CW	Clean wave
MC	Modulated carrier
WLAN	Wireless local area network
RLAN	Radio local area network
DSSS	Dynamic sequence spread spectrum
OFDM	Orthogonal frequency division multiplexing
FHSS	Frequency hopping spread spectrum
GNSS	Global Navigation Satellite System
C/N_0	Carrier to noise-density ratio, expressed in dB-Hz

13 Document history

Version	Applied changes	Date of release
-/-	Initial release – DRAFT	2021-06-25
	Final release	

14 Accreditation Certificate – D-PL-12076-01-04

first page	last page

DAkkS Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV
Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition

Accreditation

The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory

CTC advanced GmbH
Untertürkheimer Straße 6-10, 66117 Saarbrücken

is competent under the terms of DIN EN ISO/IEC 17025:2018 to carry out tests in the following fields:

Telecommunication (TC) and Electromagnetic Compatibility (EMC) for Canadian Standards

The accreditation certificate shall only apply in connection with the notice of accreditation of 09.06.2020 with the accreditation number D-PL-12076-01. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 07 pages.

Registration number of the certificate: **D-PL-12076-01-04**

Frankfurt am Main, 09.06.2020

by order Dipl.-Ing. (FH) Ralf Egner
Head of Division

The certificate together with its annex reflects the status at the time of the date of issue. The current status of the scope of accreditation can be found in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH.
https://www.dakks.de/en/content/accredited-bodies-dakks

See notes overleaf.

Deutsche Akkreditierungsstelle GmbH

Office Berlin
Spittelmarkt 10
10117 Berlin

Office Frankfurt am Main
Europa-Allee 52
60327 Frankfurt am Main

Office Braunschweig
Bundesallee 100
38116 Braunschweig

The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAkkS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf.

No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkkS.

The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAkkS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations.

The up-to-date state of membership can be retrieved from the following websites:
EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.nu

Note: The current certificate annex is published on the website (link see below).

https://ctcadvanced.com/app/uploads/2020/06/D-PL-12076-01-04_Canada_TCEMC.pdf

15 Accreditation Certificate – D-PL-12076-01-05

first page	last page

DAkkS Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV
Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition

Accreditation

The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory

CTC advanced GmbH
Untertürkheimer Straße 6-10, 66117 Saarbrücken

is competent under the terms of DIN EN ISO/IEC 17025:2018 to carry out tests in the following fields:

Telecommunication (FCC Requirements)

The accreditation certificate shall only apply in connection with the notice of accreditation of 09.06.2020 with the accreditation number D-PL-12076-01. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 05 pages.

Registration number of the certificate: **D-PL-12076-01-05**

Frankfurt am Main, 09.06.2020

by order Dipl.-Ing. (FH) Ralf Egner
Head of Division

The certificate together with its annex reflects the status at the time of the date of issue. The current status of the scope of accreditation can be found in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH.
https://www.dakks.de/en/content/accredited-bodies-dakks

See notes overleaf.

Deutsche Akkreditierungsstelle GmbH

Office Berlin
Spittelmarkt 10
10117 Berlin

Office Frankfurt am Main
Europa-Allee 52
60327 Frankfurt am Main

Office Braunschweig
Bundesallee 100
38116 Braunschweig

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The up-to-date state of membership can be retrieved from the following websites:
EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.nu

Note: The current certificate annex is published on the website (link see below) of the Accreditation Body DAkkS or may be received by CTC advanced GmbH on request

https://ctcadvanced.com/app/uploads/2020/06/D-PL-12076-01-05_TCB_USA.pdf

#################################### END OF TEST REPORT ####################################